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Automotive Industries



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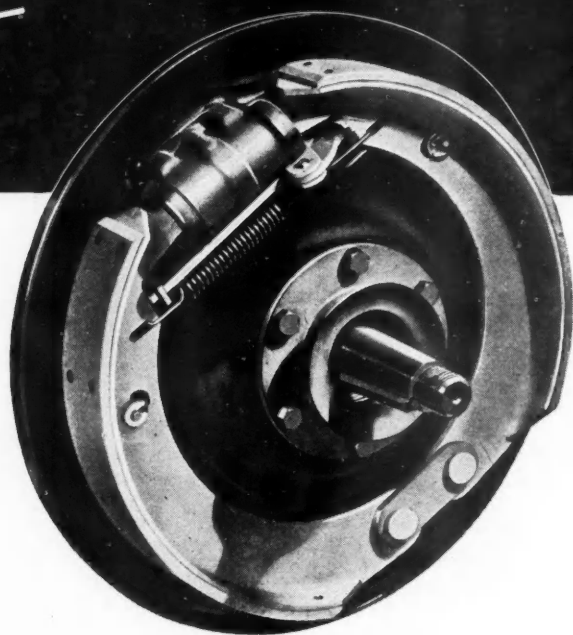
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July 6, 1935

Automotive Industries

June Ends In Big Sales Spurt

July Schedules Expected To Approach 300,000 Mark

by Harold E. Gronseth

Detroit News Editor, Automotive Industries

Having wound up the first half of 1935 in a blaze of glory, the motor industry goes into the final six months' period with highly encouraging outlook.

An amazing burst of strength in retail sales during the final week of June has somewhat baffled motor executives who were reconciled to a seasonal slackening in demand. The week ended June 29, however, saw several new high marks established in retail deliveries while other companies reporting weekly disclosed figures that skirted the best levels of the year.

Companies were at a loss to account for the unexpected upturn. Probably the best explanation is that what already was a healthy market had been further stimulated by pre-holiday and pre-vacation buying. Reports for the next few weeks will be watched eagerly for an indication of whether 1935 will repeat the performance of 1933 and 1934 by establishing the year's peak for sales in July. In 1932 the year's high was in June. In two of the last ten years the peak was reached in May while five years show April as the best sales month.

Motor officials are making much of the improved economic status of the farmer and the prospect of bumper crops in many sections of the country this year. They trace the sustained summer demand to the increased buying power of the farm communities. Optimism is greater they report in the

(Turn to page 17, please)

Dealer Query on Voluntary Agreements Goes to FTC

WASHINGTON, July 3—Chairman James L. O'Neill of NRA today revealed that automobile dealers had addressed an inquiry to NRA regarding plans for entering into a voluntary agreement. Mr. O'Neill said the inquiry has been turned over to the Federal Trade Commission, which will have charge of fair trade practices. The NRA will have charge of labor provisions as to hours and wages only, and even these will be exclusively of a voluntary character, to be filed or not to be filed with NRA as industry may choose.

Mr. O'Neill said the automobile retailers are especially interested in maintaining fixed used car allowances. Outside of government circles, however, the question has arisen as to how these standards might be maintained under voluntary agreements when it is well known that the dealer code, with supposed legal sanction back of it, broke down on this as well as other provisions.

Except for copper products and the automobile retail group no other large groups have made inquiry concerning possibilities under voluntary agreements.

LaFayette Price Range \$595-\$700; 6 Body Styles

Nash Motors Company announces six body styles for the 1936 LaFayette line, ranging in price from \$595 for the three-passenger business coupe to \$700 for the six-passenger, four-door touring sedan with trunk. Details follow:

3-pass. Business Coupe.....	\$595
5-pass., 2 dr. Victoria.....	625
5-pass. Coupe, rumble seat.....	650
6-pass. Victoria, with trunk.....	655
6-pass., 4 dr. Sedan.....	657
6-pass., 4 dr. Tour. Sedan with trunk..	700

The 1935 line consisted of a Standard and Special series, the former ranging in price from \$585 to \$700 and the latter from \$700 to \$750.

Court Approval Expected For 10,000 More Willys

Court authority to manufacture at least 10,000 more Willys 77's is expected to be granted within a few days. Bondholders and creditors have virtually agreed upon the terms of the operating order.

Production was shut down this week but will be started again next week to clean up the balance of the 15,000 court allotment. Fewer than 200 workmen were on the job during the current week.



Andre Citroen

Andre Citroen Dead; Worry Thought Cause

Manufacturer Introduced Mass Production Methods Into French Industries

Andre Gustave Citroen is dead.

Worry over the disaster that befell his automobile business aggravated a stomach disorder for which the French industrialist, often called the "Henry Ford of France" had entered a hospital some weeks ago for treatment. His entry into the hospital was too late, physicians said, for them to successfully operate.

The vast automobile plant, once estimated to be worth 2,000,000,000 francs was forced into receivership Dec. 21, 1934. The famous engineer tried unsuccessfully to remain with the company he founded as a technical advisor, but a financial investigation of the concern so aroused stockholders that M. Citroen was forced to retire from its affairs.

At the close of the war M. Citroen made his decision to enter the automobile industry, producing on a mass basis paralleling American methods. Production was begun on his 10 h.p. car in 1919 and rapidly reached the 100 car per day output class. Progressively, Citroen production rose to 400 cars per day and it was under M. Citroen's impulse that cars operating in France rose from 100,000 to 1,500,000 in a comparatively short time. At one time it was estimated that 40 per cent of the cars operating in his native land were Citroens and that 80 per cent of the Paris taxicabs were of the same make.

Not only in production methods did M. Citroen follow American ideas, but he also

(Turn to page 17, please)

NADA Optimistic Over Factory-Dealer Relationships Covered in Recent Brief

"Encouraging progress and a willingness on the part of the manufacturers to listen and consider such plans most carefully" is reported in the current issue of the *NADA Bulletin*, in connection with its efforts to secure a contract rider including the essential provisions of the now defunct dealer code.

Reporting on the results of the brief of dealer objectives submitted to the manufacturers early in June (AI, June 8, Page 754), the *Bulletin* says it was considered at a meeting of the AMA board of directors on June 19 but that no commitments were made. Letters acknowledging the brief from W. R. Tracy, Hudson; Roy Faulkner, Auburn, and Paul G. Hoffman, Studebaker, are reproduced in the *Bulletin*. "Others, so far, have failed to make any commitments, apparently holding off until they have had a full opportunity to study the objectives," the *Bulletin* continues.

"In the meantime, through conferences, NADA is endeavoring to overcome the obstacles which are brought up and is insisting specifically upon recognition of the principle of used car control as the key to open the door to greater prosperity. . ."

Of the three letters referred to, only Mr. Hoffman's discusses the dealer proposals in any detail. On cancellation, he said that this club is not used by Studebaker and that some consideration had been given to its elimination. It might be removed from distributor contracts but some distributors are averse to having it removed from their contract with dealers. The proposal for punitive

cancellation for over-allowances on used cars, Mr. Hoffman, describes as "inconsistent".

As to the proposals on fleet discounts and on protection for dealers on price reductions and on clean-ups, Mr. Hoffman said he was sympathetic to any policy along this line to which competing manufacturers would agree. On the same basis, Mr. Hoffman endorses a mark-up on freight.

The proposal to control used car allowances through fixed allowances, Mr. Hoffman does not regard as sound because it is not fair to the customer, nor does it recognize the specialized marketing ability of dealers selling high and medium-priced cars. Because of this ability, he contends that dealers handling these classes of new cars can get higher prices for the larger used cars than dealers selling low-priced lines.

He also objects to this proposal because of its unenforceability, asking "Is it not the most unrealistic type of wishful thinking to believe that automobile factories competing with each other for the favor of dealers can or will enforce codes which the government of the United States was unable to enforce?"

NADA Applies to FTC for Trade Practice Conference

In an effort to continue recognition of certain principles of the old dealers' code the NADA has applied to the Federal Trade Commission for a trade practice conference under Classification No. 1. This means that if the application is approved the commis-

sion, through its agencies, will enforce provisions against unfair trade practices.

The NADA has pointed out that trade practice provisions falling under Classification No. 1 have thus far been sustained by the courts and do not conflict with existing laws such as the Sherman and Clayton Acts. However, it was said at NADA headquarters that before any final determination is reached on this matter the entire situation will be explored definitely to determine whether the Commission can serve the trade effectively and that it offers real enforcement possibilities.

DeSoto to Add Luxury Equipment at Extra Cost

To meet an increasing demand for luxury appointments on cars L. G. Peed, vice president of DeSoto, has announced that that company will include such equipment on all DeSoto Airstream models at an extra cost of \$35 per unit.

The equipment includes front fender lamps, dual horns, dual windshield wipers, dual tail lamps, rear wheel fender shields, cigar lighter, carpeted front compartment instead of a rubber mat.

Hurlburt to Head Hupp Sales; Clarke Is Aide

William B. Hurlburt has joined the Hupp Motor Car Corp. as vice-president and director of sales. The appointment was announced by Vern R. Drum, president. Before joining the Hupp organization, Mr. Hurlburt was associated with the Chrysler Corp. as sales director; Packard, Stearns, Locomobile and Wills-St. Clair. He also was president of the Hurlburt Motor Truck Co. and more recently has been associated with the Bellanca Aircraft Corp. as executive vice-president.

Following his appointment by Hupp, Mr. Hurlburt named George Clarke as assistant director of sales. Mr. Clarke has been associated with Hupp previously as branch manager in Detroit and as a distributor in Minneapolis, Rochester and on the Pacific Coast. At one time he was branch manager for Overland in Detroit, and at another time was president and general manager of the Republic Truck Sales Corp. on the Pacific Coast. He also was associated with Chrysler as a regional manager.

Canadian New Car Sales Up 32% in First 5 Months

May sales of new passenger cars in Canada totaled 13,832 with 2694 trucks for a total of 16,526 units, according to government statistics. New passenger car sales for the first five months of this year were 47,127, an increase of 32 per cent over the corresponding period of 1934. Truck sales increased 75 per cent in the same months.

The total unit sales for the January-May period were 56,100 units, an increase of 10,768 units over the entire 12 months' sales of 1933. A recent Canadian government survey indicates that four western provinces show the greatest relative improvement over May, 1934, both in month and five-month totals.



More than 100 miles of the surgical tape shown in the picture have been used in the DeSoto body plant during the first six months of this year. This is enough tape to supply 10 hospitals for one year. The tape is used to protect grained metal instrument panels which are welded into the front-end assembly of DeSoto Airflow bodies before they are painted.

Discuss Uniform System of Indicating Line Turnover

Adoption by replacement parts makers of standardized designations indicating the turnover rates of the different parts in their lines, is discussed in a bulletin issued by the Motor and Equipment Manufacturers Association. There are many such systems in use, the bulletin says, but the trouble appears to be in the variations with consequent confusion to jobbers using them. Adoption of uniform symbols to designate the various groups of parts ranging from fast-moving down to obsolete, would clarify the situation some jobbers believe and would help them materially in stockkeeping. The association is asking members for their opinions on the subject.

United Aircraft Companies Consolidate Into One Corp.

Consolidation into one company of Pratt & Whitney Aircraft Co., Hamilton Standard Propeller Co., Chance Vought Corp. and Sikorsky Aircraft Corp., subsidiaries of United Aircraft Corp., has been completed according to Donald L. Brown, president. The new company will be known as the United Aircraft Mfg. Corp.

Stockholders of the various companies approved the consolidation at meetings held last month. According to Mr. Brown, the change was made solely for the purpose of providing the United Aircraft group with a simplified corporate structure and implies

no change in personnel or their respective duties. Neither does the change affect the status of the United Aircraft Corp., the parent company.

Glancy Gets State Post

A. R. Glancy, former General Motors executive, has been appointed a member of the Public Trust Commission of Michigan. The appointment was made by Governor Fitzgerald.



Six Cadillac executives photographed at a factory picnic. From left to right they are Scott Tyler, head of plant production; C. A. Raffrey, assistant works manager; V. A. Olsen, works manager; Nicholas Dreystadt, general manager; Dan Hulgrave, manager of purchases; A. T. Strong, general foreman of die and press room.

compares with 1,028,542 for the same period of 1934. This is a loss of 35,960 units.

There was a gain of two per cent in the \$751 to \$1,000 class and an increase of 16.7 per cent in the \$3001 and over class.

A break down of truck production totals by capacities indicates that in four general divisions substantial gains were made in all but one section. The greatest increase occurred in the special vehicle and bus class where the five months total was 1595 for the current year against 775 for the same period of 1934, a gain of 106 per cent. In the 1½ ton and less capacity group 322,975 trucks were produced this year which compares with 258,544 for last year, an increase of 25 per cent; the two to three ton group totaled 15,058 this year against 17,124 for the January-May period of 1934, a loss of 12.4 per cent; the 3½ tons and over division total output was 2,837 units which compares with 2327 for the first five months of last year, a gain of 22 per cent.

Lower Medium Priced Cars Make Biggest Gain in First Five Months Production

Analysis of passenger car production by wholesale price classes reveals that only in three groups in the first five months were gains made over the 1934 totals, and these directly account for the increased output. The greatest gain was made in the lower medium price group, \$501 to \$700, wholesale, almost alone accounting for the 177,969 increase in total output. Total produc-

tion in this division was 599,245 for the first five months of this year against 378,233 for the corresponding months of last year, a gain of 12.1 per cent for a total of 121,012 additional cars. While in total number of units the lowest price class predominated the field, yet production in this division fell off 3.4 per cent. The output was 992,582 for the first five months of this year which

Hudson Dealers Urged to Use NADA Guide Book

Hudson dealers have been urged to continue to use and promptly report used car sales to the NADA official used car Guide Book in a letter recently sent out by W. R. Tracy, Hudson general sales manager.

In his letter Mr. Tracy said: "The correct reporting of used car sales to the NADA by all dealers and distributors and the method used in arriving at the proper values make the Guide a very authentic source from which to obtain the necessary information regarding used cars to properly conduct a retail department."

Joseph Lawrence Myers

Joseph Lawrence Myers, vice-president and director, General Motors Acceptance Corp., died at his summer home in Sharon, Conn., last week. He was 61 years old.

Mr. Myers had been actively associated with the General Motors Acceptance Corp. since its inception in 1919 and served as contact officer with the banks throughout the country, his previous experience having been along banking and investment lines.

Passenger Car Production by Wholesale Price Classes

(U. S. and Canada)

Five Months 1935 and 1934 Compared

	1935	1934	Per Cent Change	Per Cent of Total 1935	Per Cent of Total 1934
\$500 and under	992,582	1,028,542	- 3.4	60.01	69.69
\$501-\$750	599,245	378,233	+58.5	36.23	25.63
\$751-\$1,000	42,624	41,774	+ 2.0	2.58	2.83
\$1,001-\$1,500	11,525	17,666	-34.8	.70	1.19
\$1,501-\$2,000	4,114	4,653	-11.6	.25	.32
\$2,001-\$3,000	2,382	3,844	-38.0	.14	.26
\$3,001 and over	1,462	1,253	+16.7	.09	.08
Total	1,653,934	1,475,965	+12.1	100.00	100.00

Truck Production by Capacities

(U. S. and Canada)

Five Months 1935 and 1934 Compared

	1935	1934	Per Cent Change	Per Cent of Total 1935	Per Cent of Total 1934
1½ tons and less	322,975	258,544	+25.0	94.31	92.75
2 to 3 tons	15,058	17,124	-12.4	4.40	6.14
3½ tons and over	2,837	2,327	+22.0	.83	.83
Special and buses	1,595	775	+106.0	.46	.28
Total	342,465	278,770	+22.8	100.00	100.00

Rally Launches Coughlin Plan for New Vertical Union in Automotive Industry

Detroit—Another campaign to organize automobile workers was launched Sunday by Fr. Chas. E. Coughlin who, addressing a rally of 6,000 workers in the coliseum at the State Fair Grounds, urged formation of a vertical union with an annual wage of \$2,150 as one of its principle objectives. Plans were announced for calling a mass meeting of all automobile workers at Belle Isle on Labor Day at which permanent officers for the union will be elected.

Fr. Coughlin outlined in detail the organization plan for the new union, which is to have a council of 12, what dues should be charged and how revenues should be used. He advocated employment of certified public accountants to examine employers' books, experienced bargainiers to deal with employers, and trained economists to advise the union on business trends when making contracts. He recommended establishment of a newspaper free of advertising, use of pamphlets and radio for educating the membership and informing the consuming public.

Suggested dues of 50 cents a month during the period workers were employed, it was estimated, would raise \$600,000 a year. Full cooperation of Fr. Coughlin's National Union for Social Justice was promised.

The speaker warned workers not to be trapped by the 30-hour week, which he called "the open door to poverty." He cautioned against admission of communists and extreme socialists to the ranks of the new organization and also said, "you can enter the Federation of Labor or stay out, as you choose." He warned against attempting to destroy the employers' profits, and injected a new thought into labor discussions by advising workers "not to take all of your wage from the employers' profits but part of it from the buying public who are not paying enough for their cars."

Coughlin failed to explain the probable

results on unemployment of any attempt to raise automobile prices. He evidently is not aware of what every manufacturer knows that price increases automatically and invariably curtail demand and in turn production and employment. This was emphatically demonstrated by the short-lived price advance of the spring of 1934. One statistician has figured that for every \$100 increase in car prices, the market roughly is cut in two.

The rally at which Coughlin spoke was sponsored by the Automotive Industrial Workers Association, an independent labor organization formed from the bargaining agencies in the Chrysler plants. Observers estimated that about one-half of the 6,000 that attended the meeting were members of the Chrysler labor organization and that a large percentage of the balance were Coughlin fans.

No great enthusiasm was evinced by labor leaders at the prospect of Coughlin's entry into the labor organization work, nor were employers disturbed. One prominent labor leader said "he was clear out of sympathy with the priest's views." Some saw in it only a political move looking to support for

the Union for Social Justice and were skeptical of his achieving any great success where experienced labor organizers have found the going so hard. Pro and con opinions were expressed by the workers. Although it was conceded that he might stir up some enthusiasm, it was felt that the religious question was bound to creep in and tend further to divide the workers, as many would refuse to follow Coughlin's leadership. He has not been particularly popular with the AFL, of which he has been severely critical. The AFL has no part in his movement. The Federation's local organizer, F. J. Dillon, was disappointed in his speech and felt that the only effect it could have would be to create additional confusion and misunderstanding. The Associated Automobile Workers union is non-committal and prefers to sound out the sentiment of its membership before indicating whether or not it will support the priest's movement. The MESA is having so many internal troubles that it is not an important factor at this time. Its officers could not be reached for comment.

Three mass meetings looking to the organization of automobile workers are now scheduled for this summer. The AAWA is planning an "open forum" late this month. The AFL has scheduled a big meeting for August 26 when charters are expected to be issued to its affiliated UAW, and on Labor Day the Coughlin rally.

Friday Sees Less Employment and Ruin for Many Companies in Coughlin Plan

Commenting on Father Coughlin's proposal to increase average wages of automobile workers to \$2,150 a year, Dr. David Friday, nationally known economist who is doing research work for the Automobile Manufacturers Association, in an interview with *Automotive Industries*, said: "If such wage rate had been in effect in 1934, it would have increased the cost of cars produced by AMA members that year by \$75.85

per unit, necessitating a corresponding increase in the price of cars to cover the additional labor expense. Total wages paid would have been \$20,000,000 larger than they were in 1929 when these companies made 75 per cent more cars than in 1934."

Dr. Friday arrives at his figures as follows: Average number of hours worked per week by the full time worker throughout 1934 was 32.5 or 1690 hours for the year. The hourly rate of wages necessary to have given him \$2,150 for the year would have been a little over \$1.27 which, multiplied by total number of hours men worked in the factory during the year, results in a total of wages for these companies \$151,000,000 greater than was actually paid in 1934. This sum divided by the number of cars and trucks produced by AMA members gives \$75.85 per car as the additional labor cost.

"Father Coughlin suggests that part of this additional cost might have been gotten from the purchaser of automobiles, while the rest could be taken out of profits of the companies. Anyone who knows anything about the profits of automobile companies in 1934, realizes that it would have been utterly impossible to draw upon profits in order to augment wages. Total profits of the 17 companies which manufactured cars and trucks last year amounted to \$84,795,000. But by no means all of these profits came from the manufacture of cars. It includes profits from refrigerators, and a host of other manufacturing activities, as well as financing operations and insurance

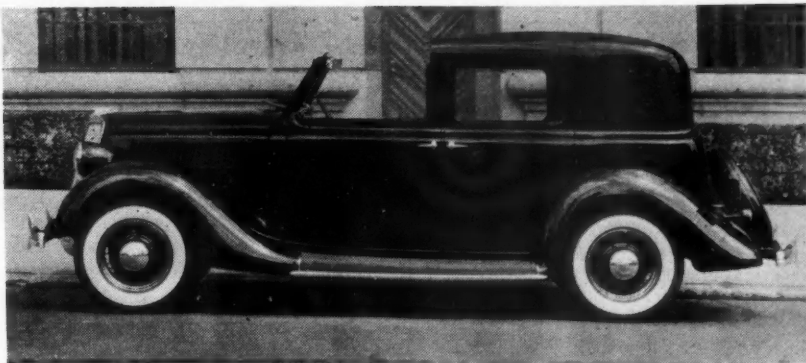


Three generations of body-builders—William J. Fleischauer, safety expert at the Fisher plant in Pontiac, Mich., his grandson, William Fleischauer III, and his son, William Fleischauer II. The grandson is an office employee at the Pontiac unit, and his father the superintendent of the "body in white" department at the larger of the two Fisher plants in Flint.

businesses. No one knows exactly how much these profits from other sources amounted to, but it is a fair estimate that they are above \$25,000,000. This leaves some \$60,000,000 net for profits before deducting dividends on preferred and common stock. This is only a trifle over \$30 per car.

"Not only were the total profits of all companies so small that they contained no margin that could be diverted to wages, but 14 of the companies made no profits whatever—only three of them were out of the 'red.' The other 13 had losses, amounting to \$22,360,000. Four of them were actually in receivership. An increase in the wage rate to \$1.27 an hour for the year would have added \$37,000,000 to the wage bill of these companies which suffered losses. This means that their total losses would have been \$59,000,000 under Father Coughlin's schedule of wages. There was no possibility therefore of further augmenting wages out of profits. As a matter of fact wage rates of the last nine months of 1934 were already maintained by encroaching upon profits. Wages during the first three months of that year had averaged 68 cents an hour. They were raised in April, and for the last nine months averaged 76 cents, a new high rate, and actually 6 per cent higher than the hourly rate of 1929. To have raised the wages to \$1.27 it would have been necessary to make a further addition of 51 cents to this average of 76 cents.

"In fact, this whole discussion is an academic one. For under car prices which were \$75 higher at the factory, the retail price would have risen at least \$100. Under those price conditions, the number of cars sold would have been far smaller than the 1,977,000 which the public actually bought last year. No one knows just how much smaller the sales would have been, but it is entirely probable that they would have been so much smaller than they were, that the total wages paid in the year to the workers would have been no greater at \$1.27 an hour than they actually were at the hourly rate which did prevail. It would simply have reduced the number of men working—the consuming public would have



The Cunningham town body on a standard Ford V-8 Chassis. It lists at \$2,600 f.o.b. Rochester, N. Y. The extension covering the chauffeur's compartment disappears into the front part of the roof.

had a much smaller number of new cars to enjoy, and the industry would still be in the doldrums as are the construction industry and most branches of the durable goods industry generally.

"Not only would labor have gone without any benefit from the increased wage rate and the consumer without his new car, but the year would have seen widespread bankruptcy among the smaller independent companies. The shrinkage in volume of production, together with the high wages, would have created losses which would have absorbed every dollar of working capital which these companies have. As a matter of fact, the proposal, no matter how well intentioned it may be, gives every promise of visiting ruin upon the independent automobile companies and no promise of accomplishing any good result whatever."

Communist Charges Hurdled In Chevrolet Union Fight

Alleging there is a Communist influence being brought into the United Automobile Workers' Federal Union No. 18384 and that some of its members are under the leadership of A. J. Muste and his Workers' Party, a group of members led by Thomas Ramsey has forced the ousting of James Roland,

chairman of the recent Chevrolet Motor Ohio Co., strike committee from the executive committee of the local.

In the battle which has raged for two weeks at various meetings of the union it was threatened at times by one group to obtain a separate charter.

At a recent meeting members were handed a mimeographed bulletin urging them to join an internal organization and signed "Communist Members of Local 18,384."

Ramsey, who led the attack against the radicals, was business agent of the union at the time of the Electric Auto-Lite strike a year ago. He is now employed by the City Auto Stamping Co., and although a member of the national council of the organization, holds no local office.

Roland will continue to serve as shop committeeman at the Chevrolet plant, it was said.

Birmingham Jobbers Assn. Agrees to Desist Order

At a hearing before Trial Examiner W. W. Sheppard in Birmingham June 26, the Birmingham Automotive Jobbers Association agreed that a "cease and desist" order should be entered against it on charges of suppressing price competition as brought by the Federal Trade Commission. Mr. Sheppard has recommended to the federal body that this disposition be made of the case.

The association through Oliver Henderson, secretary-treasurer and attorney, declared the organization was merely abiding by the NRA code and denied any attempt to restrain trade.

The Commission said at its Washington office that this order would be issued shortly after an agreement had been reached upon the terms of the order. What the nature of the terms of agreement will be was not revealed by the Commission.

May Registrations Led Factories Car Sales

Final May figures show that for the first time this year, registrations of new cars and trucks were in excess of factory sales. May car registrations totaled 293,201 against sales to dealers of 286,608, an indicated decrease in dealer stocks of 6,593 units. Truck registrations were 47,968, which was 1,084 in excess of factory sales.

New Car and Truck Registrations for May and the First Five Months

	May, 1935	April, 1935	May, 1934		May, 1935	April, 1935	May, 1934
Auburn	561	564	598	Lincoln	213	192	223
Buick	7,082	6,952	5,310	Nash	1,593	1,748	1,738
Cadillac	549	541	683	Oldsmobile	17,930	17,661	9,331
Chevrolet	59,209	75,083	57,795	Packard	3,964	3,236	516
Chrysler	5,217	5,204	3,713	Pierce-Arrow	75	75	211
De Soto	2,957	3,084	1,457	Plymouth	43,713	42,707	33,291
Dodge	20,092	20,302	9,058	Pontiac	16,058	16,038	9,237
Ford	93,467	105,479	68,051	Reo	418	411	519
Graham	1,838	1,891	1,537	Studebaker	4,479	4,527	4,142
Hudson	2,486	2,544	2,703	Terraplane	6,113	6,156	5,447
Hupmobile	877	947	656	Willys	981	952	822
La Fayette	1,684	1,917	978	Miscellaneous	52	62	247
La Salle	1,593	1,379	962				
				Total	293,201	319,652	219,225

New Truck Registrations

	May, 1935	April, 1935	May, 1934		May, 1935	April, 1935	May, 1934
Autocar	78	79	146	Indiana	27	24	45
Brockway	97	109	117	International	4,807	4,554	2,849
Chevrolet	16,284	15,024	14,148	Mack	189	159	212
Diamond T	570	568	508	Reo	616	449	578
Dodge	5,381	5,708	4,441	Studebaker	229	189	193
Federal	193	177	186	White	267	285	499
Ford	17,591	17,943	14,390	Miscellaneous	756	647	488
G.M.C.	883	870	1,031				
				Total	47,968	46,785	39,831

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for Automotive Industries

The trend of business was irregular last week, with an apparent general downward tendency. The recession was due in part to a sharp decline in bituminous coal production, which has moved erratically for some time with changes in the labor situation. Retail trade was comparatively well maintained.

Car Loadings Decline

Railway freight traffic decreased sharply during the week ended June 22. Loadings for that period totaled 567,847 cars, showing a drop of 85,245 cars, or 13.1 per cent., from the total for the preceding week, and a decline of 55,475 cars, or 8.9 per cent., from that for the corresponding period last year.

Chain Store Sales Gain

Chain store trade in May presented a mixed trend, according to *Chain Store Age*, with total results substantially under seasonal proportions. Average daily sales of 18 leading chains totaled approximately \$5,298,000, showing an increase of 2.2 per cent over the figure for May, 1934.

Current Output Rises

Production of electricity by the electric light and power industry for the week ended June 22 was 6.0 per cent larger than that in the corresponding period last year. The gain over last year's comparable figure was 4.6 per cent a week earlier, 4.2 per cent two weeks earlier, and 3.3 per cent three weeks earlier.

Industrial Indexes

The Federal Reserve Board's index of industrial production for May stands at a preliminary figure of 85 (1923-25 aver-

age = 100), as against 86 in April and 86 in May, 1934. The index of factory employment, adjusted for seasonal variation, is 81.3, as compared with 82.3 a month earlier and 82.6 a year ago.

Crude Production Higher

Average daily crude oil production for the week ended June 22 amounted to 2,728,300 barrels, showing an increase of 4,250 barrels from the output for the preceding week, and also exceeding the Federal allowable figure of 2,651,000 barrels, which became effective on June 1.

Fisher's Index

Professor Fisher's index of wholesale commodity prices continued to decline last week, standing at 81.6, as against 82 a week before and 82.3 a fortnight before. The current figure is the lowest reported since last April.

Federal Reserve Statement

Federal Reserve bank credit outstanding decreased \$10,000,000 during the week ended June 26, with an increase of \$1,000,000 in industrial advances more than offset by a decline of \$11,000,000 in other Reserve bank credit. The monetary gold stock rose \$20,000,000 and member bank reserve balances \$33,000,000, while Treasury cash and deposits declined \$32,000,000. There was no change in the amount of money in circulation.

who are familiar with highway safety activities and ask them to submit a definite plan of coordination. Mr. Rodgers states in his letter that coordination of states, municipalities and organizations activities, by making available personnel which would not otherwise be employed would "tremendously increase the value and the results which can be obtained." Mr. Rodgers also says that the organization for using work relief personnel in these projects already exists in most states and with the development of a national plan of action could commence to function within a relatively short time.

Motor Accident Deaths Lower, Census Bureau Says

Deaths resulting from automobile accidents are showing a decline according to a report just released by the Bureau of Census of the Commerce Department. Reports from 86 key cities show that 3969 persons died as the result of automobile accidents during the first 25 weeks of this year as compared with 3978 deaths in the corresponding period of 1934.

During the week previous to the issuance of the report 28 of the reporting cities reduced accidents from the previous seven day period and 46 cities had no deaths by automobiles for that week. During the same week of 1934 there were 158 deaths.

Harvester Buys 42-Acre Tract for Plant Expansion

The International Harvester Company has purchased a 42-acre industrial tract in the Calumet district, across the street from the Wisconsin Steel Works, a subsidiary. The property lies on the west bank of the Calumet River, the Indiana Harbor Belt Line and the Pennsylvania Railroad and a private slip. It is to be used for future expansion, company officials state.

Plan Automotive Display at Texas Centennial Show

Plans for the construction of a transportation building in which it is hoped to present a complete exhibit of modern transportation have been announced by officials of the Texas Centennial Central Exposition opening in Dallas, June 6, of next year.

Present plans contemplate displays by leading car, parts and accessories manufacturers both of this country and overseas. Exposition officials have said they anticipate some car producers will erect their own buildings in the vicinity of the Transportation Building. One section of the Transportation Building is to be devoted to a display of fine workmanship in connection with the construction of a modern automobile.

Timken Promotes Williams

S. D. Williams has been appointed manager of tube sales by the Timken Steel & Tube Co. His headquarters will be in Canton, Ohio. Mr. Williams joined the Timken organization in 1926 as metallurgical sales engineer and in 1932 was named assistant director of sales.

L-O-F New Plant Addition to Facilitate Production

Libbey-Owens-Ford Glass Co. has started a new \$100,000 addition to its safety glass plant at Toledo to enable it to continue production during off-peak periods.

A large warehouse of one-story brick and concrete, completely air-conditioned and humidity controlled, is the principal unit in the new layout. Additional factory office space and a new box factory are included in the expansion program.

Highway Safety Programs Grouping Proposed to FDR

A proposal for a national highway safety coordinating program that would afford work relief for the "white collar" group has been laid before President Roosevelt by Ted V. Rodgers, president of the American

Trucking Associations. Mr. Rodgers' proposal was communicated to Mr. Roosevelt in a letter sent June 28.

In his letter Mr. Rodgers points out that Congress has appropriated \$300,000,000 to be used for educational activities designed to give work relief to the white collar class and recommends, in line with President Roosevelt's proposal for renewed effort toward reduction of automobile fatalities, that "the coordination and extension of the highway safety activities now being carried on would afford excellent opportunity to make use of a large number of clerical employees and workers in similar classifications."

Mr. Rodgers points out that his organization is vitally interested in the highway safety problem and that it is developing a national program of safety education among owners and truck operators throughout the country. The ATA head suggests that the President call a conference of state officials

Perkins Labor Policy Recommendations Coincide with Industry's Own Attitude

WASHINGTON, July 1.—Sharp are differences in the New Deal-supported Wagner-Connelly labor disputes bill and the annual report for the fiscal year 1934 of Secretary of Labor Frances Perkins disclose a conflict within the administration over a labor policy. The confusion is increased by reason of the fact that the report was released almost immediately after passage by both branches of Congress of the Wagner-Connelly measure now in conference.

The contrast of policy between the bill and the report is marked on several fundamental points. Indicative of this fact is the definite government authority act up in the Wagner-Connelly Bill to enforce so-called fair labor practices on employers in connection with the guarantee to labor of the right of collective bargaining as against Secretary Perkins' declaration that "labor policy in a democracy is not a program conceived by the government." Industry, in its vigorous opposition to the Wagner-Connelly Bill, has taken precisely the same attitude as that taken by Miss Perkins. Yet Miss Perkins has supported the Wagner-Connelly Bill but was unsuccessful in her effort to have the National Labor Relations Board, its administrative body, made a part of the Department of Labor.

Organized labor has made much about the right of collective bargaining. Such a right has not been challenged by responsible industry, though it has attacked coercive means. Organized labor has demanded that this right be enforced by the government. The Wagner-Connelly Bill as one of its cardinal principles gives the power of such enforcement to the government. Miss Perkins treats the matter of such government power lightly, for she expresses the view that labor policy in a democracy is "a program of action which the people who earn their living as wage earners and those who employ them in a profit-making enterprise must work out together in a society which develops naturally out of the work that they do and the life they lead." It would be difficult to make a better argument for the employee representation plan when sincerely applied.

The simple role Miss Perkins suggests for the government is set forth in her declaration that "The function of the government is to serve as a stimulating agent to facilitate the formation of such a policy, which will be just and fair to all the people and in the line of human progress."

Miss Perkins also would lay obligations on labor as well as industry, and her conception of such obligations is interesting in view of the "rights" given labor by the Wagner-Connelly Bill.

"If labor's rights are defined by law, and government," she says, "then certain obligations will, of course, be expected of wage earners, and it is for the public interest that those obligations should be defined by labor itself and that such discipline as is necessary should be self-imposed and not imposed without."

Whatever may be done under its administration, the fact remains that the Wag-

ner-Connelly Bill would leave to the National Labor Board the working out of rights of labor. Thus the obligations of labor would not be self-imposed.

Miss Perkins in the course of her recommendations says that "The government ought to do everything in its power to establish minimum basic standards for labor below which competition should not be permitted to force standards of health, wages and hours."

The great bulk of industry today has imposed that principle on itself, and readily adopted it under codification. It was not until the Recovery Act was proposed that organized labor would assent to the fixing of minimum wages.

Fairly executed it is evident industry would welcome other recommendations made by Miss Perkins, among them:

"That the government ought to make such arrangements and use its influence to bring about arrangements which will make possible peaceful settlement of controversies and relieve labor of the necessity of resorting to strikes in order to secure equitable conditions and the right to be heard;

"That the ideal of government should be through legislation and through cooperation between employers and workers to make every job the best that the human mind can devise as to physical conditions, human relations and wages;

"That government should encourage such organization and development of wage earners as will give status and stability to labor as a recognized important group of citizens having a contribution to make to economic and political thought and to the cultural life of the community;

"That government ought to arrange that labor play its part in the study and development of any economic policies for the future of the United States."

The unfortunate thing is that the report was made public after Congress had acted on the Wagner-Connelly Bill and that Congress did not accept its principles rather than those of that measure.

Tuskegee Wants Motor Vehicles for Shop Work

Tuskegee Institute in Alabama has sent out a call for old trucks and delivery wagons to use for practice and training in its automobile shops. The institute, a school where Negro boys and girls are trained to be self supporting, is maintained largely through voluntary contributions and therefore is appealing to automobile manufacturers who may have such vehicles on hand and who would be willing to donate them to the school.

Dr. F. D. Patterson, president, Tuskegee Institute, Alabama, or Robert Stuart, 25 East 26th Street, New York City, will make all arrangements for transporting donated trucks to the school.

Thermoid Assigns Ross, Allen to Detroit Office

E. R. Ross has been assigned to the Detroit office of the Thermoid Co. His duties will include sales promotion, engineering and development work on friction materials and brake linings. D. P. Allen also has been sent to the Detroit office of the same company and has been assigned to the carpet sales division.

Prior to joining Thermoid, Mr. Ross was associated with Warner Gear, General Motors Truck, Raybestos, GATKE and Asbestos Textile.

ATA Votes \$250,000 Fund to Continue Association

To continue the American Trucking Associations, Inc., the meeting of the industry's leaders held in Washington last week voted a budget of \$250,000 for the coming year which is being apportioned among the states. About 35 operators present subscribed a total of \$15,000 to provide immediate funds.



A portion of the Ford Motor Company exhibit at the San Diego exposition. The display illustrates ductility, torsion and heating tests used at the River Rouge plant before materials are accepted for use in the V-8.

Wagner Labor Bill Waits President's OK; Court Test Looms On Constitutionality

Washington, July 2—The Wagner Labor Relations Bill arrived at the White House yesterday and all signs point to its early approval by the President.

Bitterly opposed by industry in this and the previous sessions of Congress, attempts to administer it by the National Labor Relations Board it creates is certain to precipitate a court test of its constitutionality, with many predicting that the Supreme Court will throw it out.

Although the general features of the measure are familiar, in view of the fact that apparently it is to become the law of the land, it seems worth while to print once more the prohibitions it places on employers. Here they are:

Sec. 6 (a). The board shall have authority from time to time to make, amend and rescind such rules and regulations as may be necessary to carry out the provisions of this act. Such rules and regulations shall be effective upon publication in the manner which the board shall prescribe.

Sec. 7. Employees shall have the right to self-organization, to form, join, or assist labor organizations, to bargain collectively through representatives of their own choosing, and to engage in concerted activities, for the purpose of collective bargaining or other mutual aid or protection.

Sec. 8. It shall be an unfair labor practice for an employer

(1) To interfere with, restrain, or coerce employees in the exercise of the rights guaranteed in Section 7.

(2) To dominate or interfere with the formation or administration of any labor organization or contribute financial or other support to it; provided that, subject to rules and regulations made and published by the board pursuant to Section 6 (a), an employer shall not be prohibited from permitting employees to confer with him during working hours without loss of time or pay.

(3) By discrimination in regard to hire or tenure of employment or any term or condition of employment to encourage or discourage membership in any labor organization; provided, that nothing in this act, or in the National Industrial Recovery Act (U. S. C., Supp. VII, Title 16, Sec. 71-712), as amended from time to time, or in any code or agreement approved or prescribed thereunder, or in any other statute of the United States, shall preclude an employer from making an agreement with a labor organization (not established, maintained or assisted by any action defined in this act as an unfair labor practice) to require as a condition of employment membership therein, if such labor organization is the representative of the employees as provided in Section 9 (a), in the appropriate collective bargaining unit covered by such agreement when made.

(4) To discharge or otherwise discriminate against an employee because he has filed charges or given testimony under this act.

(5) To refuse to bargain collectively with the representatives of his employees, subject to the provisions of Section 9 (a).

The prohibitions are to be enforced by the

National Labor Relations Board and its agents, who are vested with wide powers of investigation including the subpoena of persons and records. The board is authorized to petition the federal courts to enforce its orders and for appropriate temporary relief or restraining order. While the board is created as an independent agency, it is not empowered to provide conciliation, mediation or statistical service now furnished by the Department of Labor.

The measure gives exclusive bargaining rights to representatives selected by the majority, although the individual or a group of workers has the right to present their grievances to their employer. Where a question arises as to who represents the workers, the board is authorized to hold elections and to determine the voting units.

In a last-minute effort to persuade President Roosevelt against signing the bill, the National Association of Manufacturers wired him urging disapproval "because it is invalid and unwise in policy." The telegram, signed by C. L. Bardo, president, stated the association believed reference of the measure to the attorney general would "disclose that the control over local employment relations sought under the fiction of the commerce power is repugnant to the well-established interpretations of that authority over three-quarters of a century and finally reiterated in the recent decision in the poultry case."

Dodge Introducing New Series of 3-Ton Trucks

Dodge Division, Chrysler Motors, is introducing a new series of 3-ton trucks in three standard wheelbases—152, 170 and 180 in. Chassis of still longer wheelbase up to 205 in., however, are available on special order.

For final drive, the choice of three standard ratios is offered—7.4, 6.8 and 6.1666. A double reduction unit with an 8.21 ratio also

is available. Transmissions have five speeds, two of which are of the so-called silent type. The ratios are fifth, direct; fourth, 1.478; third, 2.395; second, 4.38; first, 7.58, and reverse 6.10.

The engine in the new series is a 3½x5 in. six with a piston displacement of 310 cu. in., taxable horsepower of 31.54 and a torque of 200 lb. ft. at 1100 r.p.m. The compression ratio is 4.7.

Plymouth to Build Four Detroit Plant Additions

Plans for construction of four additions to the Detroit plant of Plymouth Motor Corp. were announced this week as the company celebrated the seventh anniversary of its entrance into the motor industry. The new buildings will add 103,900 sq. ft. of floor space, giving Plymouth a total of nearly 1,000,000 sq. ft. Announcement of the Detroit expansion follows closely upon confirmation by K. T. Keller, Plymouth president, of reports that Plymouth would spend over \$1,000,000 to re-equip its two plants in Evansville, Ind., in preparation for initial production there of 300 cars daily.

Added space afforded by new construction at the Detroit plant will be used for storing bodies and to increase space available for production lines by moving such non-productive departments as factory maintenance, tool rooms, machine repairs and shop supplies into the new buildings. Space will be provided for storing 500 bodies in one section of the new additions. Completion of the Evansville and Detroit projects will give Plymouth capacity of about 2,400 cars daily including its Los Angeles plant.

Stewart-Warner Corp.

A preliminary statement issued by the Stewart-Warner Corp. for the three months ended June 30 indicates earnings for the quarter will be slightly larger than the \$496,063 net profit reported for the first quarter of the year. With the anticipated second quarter profits it is expected earnings for the first six months of the current year will be around \$1,000,000. This compares with the net profit of \$540,260 reported for the first six months of last year.



New Dodge three-tonner

Steel Makers Ponder Code Price Controls

Prices Holding Steady But Market Awaits Test of Big Tonnage Orders

Activity in the steel market this week was restricted to routine specifying. Nearly all the steel mills suspended operations over the Fourth, quite a few of the finishing units having stepped up operations in the preceding week to make up for the one day's loss of output. Fairly good operating rates are forecast for next week.

In sharp contrast with recent years, the industry is doing quite well during the early part of the season generally looked upon as the year's dull period in the steel market. Detroit district finishing mills are operating at very close to capacity. With more and more assurance that new model assemblies will become general immediately after Labor Day, a gradual pick-up after Aug. 1 is confidently expected by flat steel producers. With their eyes on fourth quarter prices, steel producers pointed out that May payrolls showed an increase of approximately 1.3 per cent, while operations receded from 45.28 to 43.53 per cent of capacity. There has also been considerable talk in the last few days that, with a view to obviating all possible trouble with the Department of Justice and the Federal Trade Commission, the open price filing system would be formally discarded before the fourth quarter price filing period in August.

Discarding by the copper producers of the "Blue Eagle" price and their return to a free play of the law of supply and demand has impressed many of the steel producers with the wisdom of dropping all restrictions set up under the code. So far prices are holding steady all along the line, but the market is still waiting for the crucial test when worthwhile tonnage business begins to come out. An interesting development is the reopening of a long idle Mahoning Valley rolling mill, which will specialize in producing flat steels in tonnages that are too small to permit of economical production in the large continuous mills.

Pig Iron—Holiday air pervaded most of the pig iron markets this week. On the Atlantic seaboard Russian iron, corresponding to No. 2 foundry, is being offered. Reports have it that prices for this type of iron are being shaded to the extent of \$1 per ton, but the tonnages so far brought in are negligible, a cargo of 1,500 tons having been imported as a try-out.

Aluminum—Quiet and unchanged. The sole American producer of virgin aluminum will have increased import facilities next year, the company's Canadian affiliate having begun construction of a plant for the chemical conversion of British Guiana bauxite into metallic aluminum.

Copper—All restrictions on the sale of copper, with the exception of a voluntary agreement by producers to make reports of all sales to their organization, have been dropped. The Navy Department opened bids on 750,000 pounds, the lowest ranging from 8.13½ to 8.35 cents for delivery to

different navy yards. At the beginning of the week, producers quoted electrolytic at 8 cents, delivered Connecticut point. In the "outside" market, speculative holders quoted 7½ @ 8 cents. Brass and copper products prices have been adjusted to the lower price of copper.

Tin—The spot Straits market, ruling dull, opened on Monday at 51¼ @ 51½ cents, very little changed from last week's close. Futures are in fair demand.

Lead—Steady and unchanged.

Zinc—Quiet.

Economic Education Duty of Management, Sloan Says

Management has a broad responsibility to the public as well as to its stockholders, Alfred P. Sloan, Jr., GM president, emphasizes in a statement published in *Printers' Ink* of June 27.

"If we cannot develop a better understanding and more intelligent dealing with our highly intricate national economy.... then we cannot effectively capitalize the great possibilities of the future," Mr. Sloan says. He believes that this better understanding cannot be developed unless it is provided by those who understand these problems and realize their implications as affecting the welfare of all.

Management must avoid politics, Mr. Sloan continues, "but if an economic question affecting the stockholders and affecting our national economy, happens to be a political question, then it should be dealt with as aggressively and conscientiously as if it were not a political question."

Briggs Manufacturing Co.

Briggs Manufacturing Company is expected to show profits for the second quarter approximately equal to those of the first when the net amounted to \$3,247,141. The volume of business was slightly less than in the first three months. Earnings for the first half of 1935 will be considerably in excess of the full year's dividend requirements at the present annual rate of \$2 a share. April was a record month for shipments and while operations declined seasonally from that point, increased demands of automobile manufacturers have necessitated stepping up operations in the last few days.

SEC Denies Request To Delist Hupp Stock

Stockholders Protection Commission's Aim; Flays Andrews in Its Decision

The Securities and Exchange Commission has denied the application of the New York Stock Exchange for delisting of the common stock of the Hupp Motor Car Corp.

In announcing its decision, the Commission said the Exchange was fully justified in making the application, but that to grant the application at this critical point in the corporation's affairs would subject the stockholders' interest to undue risk. It declared that "a contemplation of salaries paid during the time of severe losses, of the treatment of the corporation by its bankers, of the Andrews and Cole contracts, of the cancellation of the Cole indebtedness, even of the Drake salary, small though it may be, of the dissension which is menacing the existence of a once prosperous enterprise, of the repeated failure of Andrews to abide by his agreements, makes us very sympathetic toward the stockholders."

The commission said that it would unhesitatingly grant the exchange's application if the conditions which prompted it still existed. However, the commission said in view of the changes made by the corporation, "of the Commission's desire to protect the interests of the stockholders, in the hope that an honest effort will be made to run the corporation for the stockholders, and considering the attitude of the directors as expressed in their recent actions," the commission had decided to deny the application. The application was denied without prejudice as to its rights as to delisting in respect of permanent registration, "on any proper grounds, including those of the present application."

Charles D. Coleman

Charles D. Coleman, representative for General Motors Truck Co. in Washington, was found dead in his apartment at the capital last week.

CALENDAR OF COMING EVENTS

SHOWS

Machine Tool Show—Cleveland..Sept. 11-21
New York Automobile Show, New York, Nov. 2-9
Detroit Automobile Show.....Nov. 9-16
Buffalo Automobile Show.....Nov. 9-16
Newark Automobile Show.....Nov. 9-16
Cincinnati Automobile Show.....Nov. 10-16
Philadelphia Automobile Show.....Nov. 11-16
Baltimore Automobile Show.....Nov. 16-23
Columbus Automobile Show.....Nov. 22-28
Cleveland Automobile Show.....Nov. 23-30
Montreal Automobile Show.....Nov. 23-30
Kansas City Automobile Show, Nov. 30-Dec. 6
Automotive Service Industries Show—Atlantic City.....Dec. 9-13

CONVENTIONS AND MEETINGS

S.A.E. National Production Meeting, Cleveland.....Sept. 18-19
National Industrial Advertising Association, Pittsburgh.....Sept. 18-20

American Transit Assoc., Bus Division, Atlantic City.....Sept. 23
National Assoc. Sales Finance Cos.—White Sulphur Springs.....Sept. 26-28
American Society for Metals, Annual Meeting—Chicago.....Sept. 30-Oct. 4
S.A.E. Transportation Meeting, Chicago.....Oct. 10
S.A.E. National Tractor Meeting, Chicago.....Oct. 10-11
National Safety Council, Louisville, Ky.....October 14-18
American Gas Association—Atlantic City.....Oct. 14-18
Los Angeles.....Nov. 2-9
S.A.E. Annual Dinner, New York.....Nov. 4
Newark, N. J.....Nov. 9-16
American Petroleum Institute—Los Angeles.....Nov. 11-14
Philadelphia.....Nov. 11-16
International Acetylene Association, Cleveland.....Nov. 12, 13, 15
Baltimore.....Nov. 16-23
National Industrial Traffic League—Chicago.....Nov. 20-21
Columbus, Ohio.....Nov. 23-28

Finished Product Was S the Production of T

UNIFORMITY in the manufacture of quiet transmission gears has been an increasingly important problem in recent years. The difficulties in obtaining satisfactory gears center largely around the final operations, including finishing before heat-treatment, heat treatment itself, lapping and assembly into the case.

It is therefore of interest to study the manner in which the Buick Motor Company solved these various problems, when it recently set up its own production line for the manufacture of transmission gears. Instead of setting up production methods and equipment that could be expected to turn a bar of steel into a finished gear, the finished gear was the starting point. Step by step, in reverse order, were determined the type of equipment and tooling, the production processes, desired tolerances for each stage and part, etc.—through heat-treatment, finishing, gear cutting, turning, and forging until the steel bar was reached.

Even here, however, control did not stop, for by means of the reverse layout method pursued, the desired characteristics for the steel itself were determinable and specifications established for close control of grain size, fibre structure, etc.

The manufacture of Buick transmission gears can be said to start with the assembly of the gears into the case, and here it should be noted that all the bores of the case are line-reamed simultaneously on a multiple line-reamer. This assures maximum accuracy as to relative location of gear centers and proper relationship of the gears to each other.

Naturally, the value of such a set-up requires that the gear and shaft assemblies in turn be concentric. Therefore, through all manufacturing operations, gears and shafts are located from fixed centers. This in turn required that the first operation following forging must be a true centering of the blank, locating from the OD of the gear blank. In addition to the conical "center" in the drive gear, the hole is also cylindrically countersunk. This section extends to the cut-off point, so

that end trimming of the piece can be done on centers.

In the hollow gears, including countershaft cluster, second speed and idler gear, the holes are first pierced to assure a uniform and close grain structure in the bore. After piercing the bores are finished by broaching. For the cluster gear, for instance, there are three broaching operations, rough, semi-finish and finish. The broach cutters, incidentally, have splines to cut .002 in. deep grooves in the hole to keep the bushing from turning after assembly.

In the idler gear, three keeways, 120 deg. apart, are cut in the bore for driving purposes, instead of the usual single keeway. This is done to assure uniform structure and prevent distortion during heat-treat by equalizing metal distribution.

Returning now to the gears, prior to assembly, the final operation on the gear teeth is a lap following heat-treat.

In this operation the gear is mounted on a driving arbor, or on driving centers, as the case may be, as if it were assembled in the transmission. The gear drives the three radially disposed cast iron laps, while it moves back and forth axially.

It was found desirable to use the minimum number of strokes possible for lapping and average lapping time per gear in fact is only two minutes. The number of strokes or revolutions of these lappers is fairly well fixed, and the amount of lapping action required, if variations are encountered, is varied by hydraulically regulating the pressure of the laps on the gears.

Since it is essential that gears be clean and free of scale when they reach the lap, Buick developed an interesting heat-treatment cycle in which gears are hardened in cyanide baths, although they are not "cyanided." The hardening baths are similar in arrangement to an

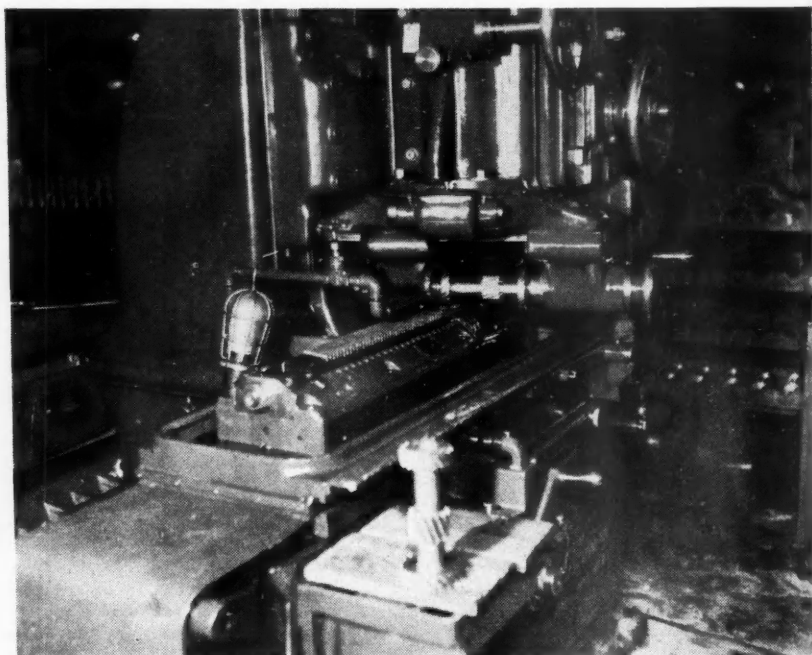


Fig. 1—The key point probably in the Buick gear-machining line is this Michigan Tool gear "shaver," the last operation prior to heat-treating. The table with the cutters reciprocates, while the gear (shown on an arbor) rolls over the rack of free centers.

Starting Point in Planning Transmission Gears at Buick

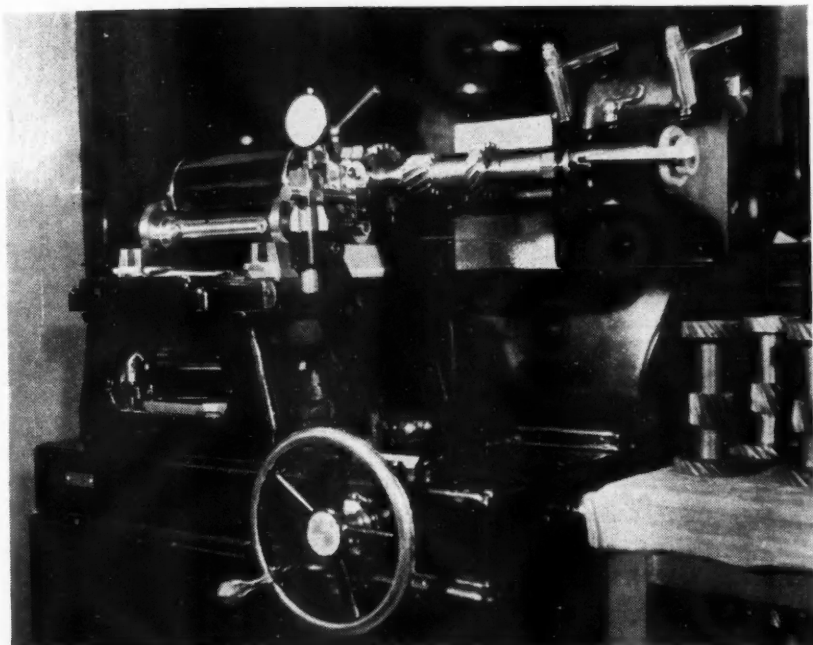


Fig. 2—While the gear-shaver compensates for dimensional changes occurring in heat-treating the gears, a constant check on such variations is carried on at Buick in one of the finest "gear laboratories" used in standard production. Here is shown a Michigan Tool lead checking machine with a cluster gear in place being checked.

automatic plating installation, an automatic conveyor being loaded with a fixed charge (as to weight) of gears, and dipping in turn into pre-heating, maximum temperature, and quenching temperature cyanide baths, and also into the quench itself.

Following this operation, gears go through a vertical automatic drawing oven. Gears coming out of this heat-treat are clean with no trace of scale. The cyanide produces a case hardening effect, of course, but this is only .002 to .003 in. deep and works well with the simple final lapping operation.

The operation of "shaving" prior to heat-treatment shown in Fig. 1 is probably the key to Buick's entire gear machining set-up, being performed on specialized Michigan Tool gear finishing

equipment. This equipment not only compensates for heat-treat changes, but also controls the manufacturing set-up prior to shaving. Gears are mounted on arbors to duplicate their position in the transmission, and are allowed to roll back and forth on a reciprocating cutting rack, which "shaves" the gear tooth to the desired form.

Buick gets about 25,000 to 30,000 gears per re-sharpening of the rack. The use of the gear shaver makes it possible to hob the gears in one operation, separate roughing and finishing cuts not being required except on the center (low speed) gear of the countershaft cluster. The latter is a fairly wide gear having a high (25 deg.) pressure angle and a 20 deg. helix, and is both rough and finish hobbled.

It was found that the tolerance variations permissible by the use of gear shavers following hobbing, made it possible to get just as many gears per hob re-sharpen as if rough and finish opera-

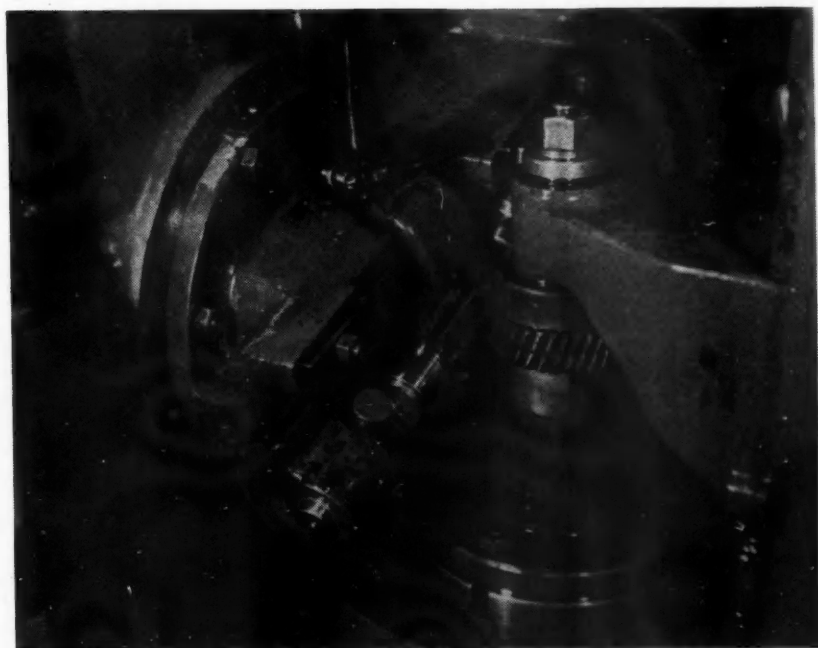


Fig. 3—The use of the shaving process makes it possible to hob gears in one operation instead of rough and finish hobbing. Here is shown a detail of one of the Gould and Eberhard gear hobbers, hobbing two low speed gears at one time, back to back. Standardization on one make of machine tool for each operation is another important reason for the consistent accuracy of Buick transmission gears.

tions were used. Furthermore, with the gear shavers in the line, Class "B" ground hobs were found quite satisfactory, thereby reducing hob costs by roughly 20 per cent. It might be mentioned here, though, that every time there is a machine or hob change, or hob-reset, gears are routed for complete checking of tooth form on the equipment in Fig. 2.

In hobbing, too, gears are located from centers. Low speed and reverse gears are hobbled in pairs, back to back, virtually doubling productivity (see Fig. 3). While the idler gear also has a 25 deg. pressure angle and 20 deg. helix angle, the comparatively narrow face makes it permissible to finish hob in one operation.

After centering, the blanks are rough and finish turned separately on automatic lathes with multiple tooling, the blank being mounted on centers and driven with a self-centering chuck. Finishing of the rear gear face, cutting to length and semi-finishing of bearing diameters, etc., are subsequently performed on Bullard automatics, to eliminate chances of error due to rechucking, etc.

On the drive gear there is a re-centering operation, which is in the form of a chamfer in the drilled ends of the piece, to correct for any errors introduced, possibly, by the machine itself.

The same facing operation, etc., on the hollow gears is performed with the gears driven onto .001 in. tight fit arbors forming part of the machine fixtures. Other turning operations, on lathes, are performed by locating and

driving with expanding centers in the bores.

Oil holes are drilled following finish turning, such holes being drilled adjacent to the gear cylinders, rather than through them. In this manner drilled holes through gear teeth are avoided. Threads on the drive gear are cut on thread millers, using driving centers for accurate locating.

Clutch splines on the drive gear are

hobbled on a group of the latest Cleveland Rigidhobs. Following heat-treat, bores and bearing seats are finished by grinding, the former with an internal grinder, but locating from the gear pitch line diameter. The bore of the second speed gear is honed for maximum accuracy. After assembly of bushings in the cluster and idler gear, these bushings are diamond bored (see Fig. 4).

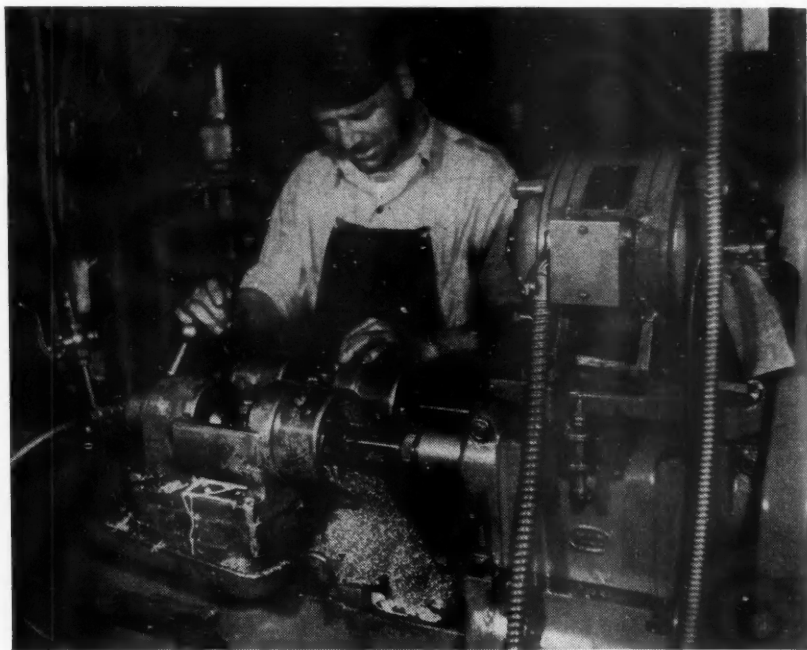


Fig. 4—Accurate finishing of gears, of course, would be useless without accurate finishing of the bores of gears which fit over a shaft, particularly after bushings are assembled in such bores. Here is shown the diamond boring operation on the idler gear bore.

Chemical Reactions in the Lead Storage Battery

ALTHOUGH battery engineers have generally accepted the double-sulphate theory of chemical reactions in the lead storage battery, its validity has often been questioned because of disagreement between the theory and certain experimental results. Experimental difficulties in proving the theory have doubtless accounted for the variety of results previously obtained. The chief difficulty lies in determining how much electrolyte, including that in the pores of the plates, is contained in the cell. This difficulty was overcome in a recent investigation at the National Bureau of Standards, reported in the April number of the

Journal of Research (RP778), by using the so-called method of mixtures. If a solution of known concentration, but unknown weight, is mixed with a carefully weighed portion of water or another solution differing in concentration, and the concentration of the resulting mixture determined, it is possible to calculate accurately the weight of either the original or final solution. This method, which has not previously been applied to this problem, has many advantages and has enabled the authors to determine not only the number of equivalents of acid used per faraday (96,500 coulombs) but also the number of equivalents of water formed. The

results of this new series of measurements are entirely consistent with the double-sulphate theory in showing that two equivalents of acid are used and two equivalents of water are formed for each faraday of electricity. No evidence of the anomalous substances postulated by some previous experimenters was found.

Open Altoona's New Dirt Track, July 27

The new dirt track at Altoona, Pa., built on the site of the old board track, will be opened officially, Saturday, July 27. Known as the Altoona-Tyrone Speedway, the new track is one and one-eighth mile.

JUST AMONG OURSELVES

The Wagner Rule Undemocratic

PROPONENTS of the Wagner Labor Relations measure affect to believe that by establishing majority rule it applies to labor relations the same principle that controls in our political affairs. The majority does control, at least theoretically, in our politics, but minorities are represented and there are plenty of evidences that that representation is often mighty effective in controlling the course of events.

Under the Wagner measure representatives selected by the majority are given exclusive rights to bargain collectively for all the workers—no provision is made for participation by minorities. How much fairer and how much closer to the democratic pattern of our government was the proportional representation plan set up by the President's automobile settlement. Under it any group or organization which could secure majority representation on the bargaining agency could override any minority if it was so minded. But minorities were provided with an avenue for the expression of their views. The Wagner measure would end this really democratic arrangement.

If the Wagner plan were applied to our political affairs there would have been no Democratic senators during the years

the Republicans controlled the Senate, and no Republican senators since the Democrats took command.

* * *

Sharing Wealth With Uncle Sam

ASIDE from a certain objective interest in the philosophical question of whether the taxing power should be used to distribute wealth, we are also bothered about how the wealth that is to be taken away from the rich and from large corporations actually is to be distributed to those in the low income brackets. Perhaps if we could think more profoundly on economic subjects, we wouldn't be faced with this difficulty.

It is, of course, easy to see how those who have are to be separated from some of their wealth. But it is not so easy for us, at least, to see how those who have not are going to be benefited directly enough for them to recognize what they are getting. And if they don't know they are being benefited, the ultimate political advantage of the proposals seem nebulous, whatever the real economic effects may be. Of course, if the government gets more money from the rich and from the big corporations it can reduce taxes on other portions of the populace, but such a small fraction of the people pay direct Federal taxes now,

except for the nuisance levies, that most of the people won't know the difference.

Turning from the political to the economic consequences, we would like to see some dispassionate discussion of a question that is inherent in the proposal to tax inheritances as we see it. That question, which may sound rhetorical but isn't meant to be, is "Will the wealth now concentrated in the nation's great fortunes be used more effectively in the public interest if it is broken up into smaller segments subject to the control of more people?" as the administration tax plans contemplate. Another question requiring elucidation is how inheritances are going to be turned into the cash which is the only thing the tax collector will accept.

* * *

Economic Planning Not So Simple

THERE is something for those who favor the so-called planned economy to ponder in what is happening at Palmer, Alaska. Apparently, things are not working out there as the 200 families which the government transported there to form a new colony had anticipated.

Planning the economy of such a relatively small colony would seem like a relatively small undertaking and one that should be handled without any difficulty—at least in comparison to planning on a national scale. Press reports indicate, however, that it has proven anything but an easy job both relatively and absolutely. In fact, this little job seems to have been pretty well bungled.

—D. B.

Problems in Flapped Cowl Control of A

THE performance of commercial and military airplanes has been greatly improved in recent years, partly by making the plane "cleaner" in the aerodynamic sense, and partly by increasing the specific output of its powerplant. Both lines of progress were complicated by the difficulty of providing the higher-powered engines with proper cooling and making them accessible while retaining the "cleanness" of the plane.

A paper on "Further Progress in Controlled Cooling of Radial Aircraft Engines" was presented at the S.A.E. Summer meeting by J. M. Shoemaker of Chance-Vought Corporation, T. B. Rhines of United Aircraft Corp.; and

of the diameter of the nacelle or fuselage behind the engine on the drag and cooling characteristics of the engine-nacelle combination. To investigate this question, tests were made on one baffle in combination with three nacelles of various diameters, the experimental arrangement being as illustrated in Fig. 1. The correct method of comparison is shown in Fig. 2, where model drag is plotted against model air flow for each of the three nacelles. Variation in flow was obtained by changes in skirt length and angle. It is plain that for most conditions the over-all drag is least with the small nacelle.

It is not uncommon at the present time to make the inside diameter of the

two points on the cowl, so that when it was opened to small angles a gap was left ahead of the hinge line but at an angle of 60 deg. this gap was closed. At any given flow this apparatus offered considerably more drag than the continuous flap arrangement.

In order to learn more about the characteristics of the normal type of cowl flap, a series of cowls having flap angles as high as 120 deg. were tested. It was found that angles greater than 40 deg. are of no use whatever and that the practical limit probably lies between 20 and 30 deg. At higher angles the long flaps do not give any materially higher flows than those of shorter chord.

Considerable experience in the design of cowls for controlled cooling indicated that there would be many important advantages in locating the flaps and their controlling mechanism fairly well back from the engine so that support could be obtained directly from the fuselage structure at the firewall. Wind tunnel tests indicated that there is no important loss in efficiency when the flap hinge point and the nacelle shoulder are moved well to the rear.

During the spring of 1935 a firewall-flap cowl was flight-tested on the Vought V-50 airplane powered with a Pratt & Whitney Twin Wasp Junior engine. The tests were made not only to determine the merits of the particular flapped-cowl arrangement, but also to investigate the action of the flaps at angles greater than 20 deg., the max-

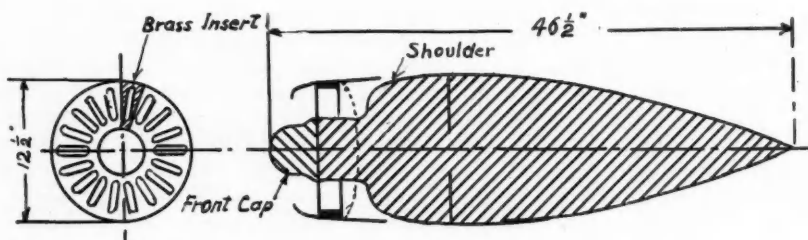


Fig. 1—General arrangement of one-quarter-size wind-tunnel apparatus

H. H. Sargent, Jr., of the Pratt Whitney Aircraft Co., in which they gave further results obtained in a coordinated research on the subject of cooling and cowling inaugurated some years ago by the subsidiaries of United Aircraft Corporation. The investigation related particularly to the properties of "close" or pressure-type baffles. The pressure baffle, closely fitted to the engine cylinders, serves the three functions of preventing the flow of air through the "engine disk" except at points close to the cooling fins, increasing the velocity of the flow, and distributing the flow to the best advantage. In the early part of the research work it was found that the drag of the cowed engine is largely dependent on the flow of cooling air through the baffles. In discussing these tests the term "efficiency" is used to express the ratio of the air flow permitted by the cowl to the drag it causes, while the term "effectiveness" is used to express the ability of a cowl to produce flow.

One of the unsettled questions in engine-cowl design has been the influence

cowl ring considerably smaller than the over-all diameter of the engine, with protuberances around the cowl circumference to provide space for the valve-rocker mechanism. This condition was simulated on models in the wind tunnel, but no important difference in aerodynamic efficiency resulted, from which it appears that the cowl with small frontal area may be used without harm when improvement in vision over the nose of the airplane is worth the increased cost of manufacture.

The flapped cowl for controlled cooling as first proposed offered certain mechanical difficulties, particularly as regards the necessity of linking together a large number of small flap sections to operate as a unit. Therefore, an investigation was made of the possibility of using flaps made in a small number of large sections. In this connection, tests were made on a cowl which incorporated four doors, each covering 70 deg. of engine circumference. The four fixed parts of the cowl skirt extended back close to the exit gill. Each of the doors was hinged at

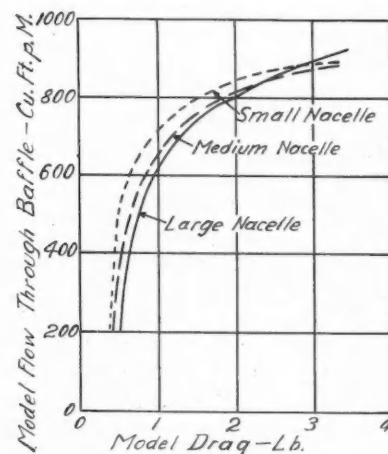


Fig. 2—Effect of size of nacelle on efficiency of cowling

Aircraft Engine Cooling Mostly Solved

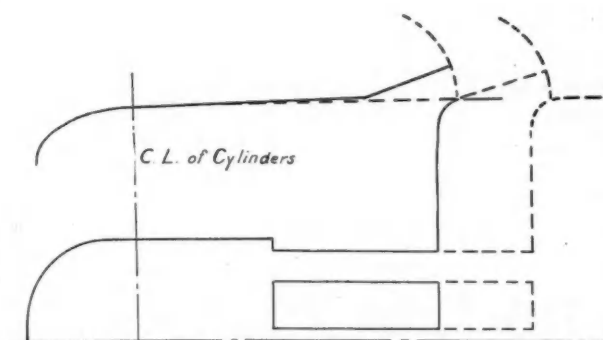


Fig. 3—Model arrangement for tests of firewall flaps

(The solid and broken lines indicate two relative locations of engine and firewall)

imum angle available with the first design of controllable cowl.

The installation included eleven interlocking flaps of $7\frac{1}{2}$ in. chord (16.3 per cent of baffle diameter) hinged to the trailing edge of a long-skirted, N.A.C.A.-type ring cowl and operable from the cockpit through an angular range of 55 deg. There was no wrapper or inner cowl between the engine and the firewall. The cooling-air-exit

gill was formed by the rear edge of the flaps and the firewall shoulder. Through the bottom 29 per cent of the cowl circumference, which was not provided with flaps because of installation difficulties, the cowl skirt extended back to the firewall, leaving practically no gill opening. The exhaust collector was placed inside the cowl and, to prevent it from heating the engine accessories, was contained in a light metal shroud

through which cooling air was circulated.

In addition to the usual flight and engine instruments, the airplane was equipped with 64 thermocouples placed to measure temperatures about the engine, and with pressure fittings at 38 positions on the cowl for studies of the distribution of air loads. Means for the determination of the air flow through the baffles and a flow tank for measuring fuel consumption were also provided.

The authors conclude their paper with the assertion that controllable cooling by means of the flapped cowl has proved its value on a wide variety of installations since it was first introduced a year and a half ago. The results of the experience thus accumulated, together with continued research and analysis of the data at hand, have solved most of the problems involved in its application.

Automatic Transmissions Must Leave Driver Some Control

INVENTORS usually overlook the fact that the most ingenious and intriguing mechanism is of no use if it cannot be sold. S. O. White, chief engineer, Warner Gear Co., pointed out in discussing John Sneed's S.A.E. Summer Meeting paper on automatic transmissions. Mr. White said there had been a revival of interest in power shifting recently and he had seen some very clever automatic power shifts, mostly vacuum-operated, applied to more or less conventional transmissions. He continued that inherent complications and manufacturing difficulties often run the cost up so high that it could not well be absorbed by the low-priced, nor even by the medium-priced field.

An automatic transmission, to be successful, must be a practical compromise, leaving the driver a certain amount of control, because the average driver does not like the effect if a shift

occurs when he does not want it or expect it. In the present state of the art a stepped-ratio transmission seems the most practical; but there must be more than two speeds, and preferably there should be four.

Mr. White discussed requirements in automatic transmissions as follows:

"It appears to be feasible to have the transmission fully automatic from first up to third, which last would be a town or traffic ratio. It then seems to be essential to have convenient manual means, such as a floor button convenient to the left foot, for putting the transmission back into second and even into low and keeping it there, regardless of car speed or torque conditions.

"For reasons of safety, as well as convenience, it should be possible to do all traffic handling with both hands on the steering wheel all the time.

"It seems most practical to do the parking manually. The convenient ar-

rangement is a substantial knob on the instrument board, with three in and out positions providing forward, neutral and reverse. A definite positive neutral is essential, and reverse must be so arranged that the driver cannot get into it accidentally.

"The most popular means for determining the gear ratios has been the engine torque. This may partly be on account of the many available ways of employing it and partly because it is a correct measure of the gear reduction needed at the moment. We, however, have yet to see a fully torque-controlled device that is satisfactory to the driver. One very disconcerting characteristic is that of dropping out of high to a lower speed at unexpected and annoying moments, when the driver had pushed a little on the accelerator for the purpose of moving the car along and not for the purpose of getting a lower speed. Our experience is that a car should remain

in high at least as far down as 10 m.p.h. on deceleration and not shift to a lower gear with moderate pressure on the accelerator.

"Another popular means for determining the gear ratios is some form of governor operating in proportion to car speed. As brought out in the paper, this also has disadvantages. One of them is the very real difficulty of designing a governor with sufficient

power to operate any mechanism at slow speeds without having plenty of weight, momentum, space and vibration troubles at fast speeds.

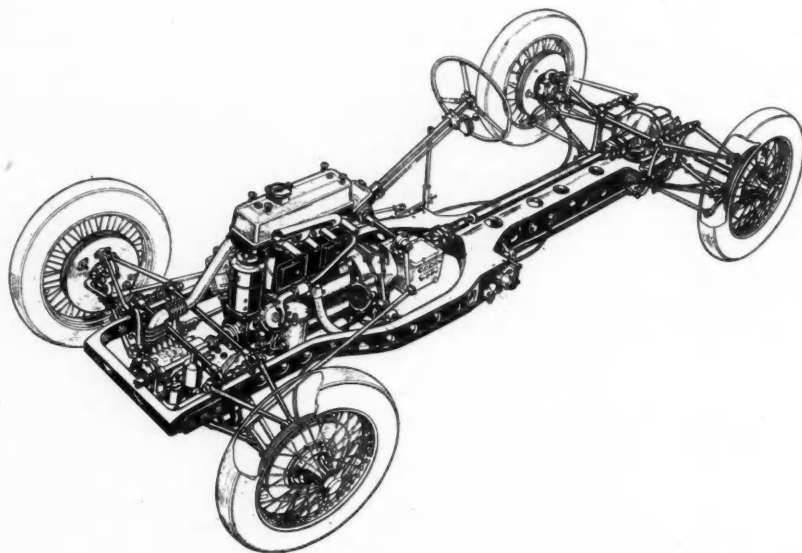
"There seem to be some practical possibilities in the way of a control combining speed with torque.

"Now, a word as to the overdrive. This provides the fourth speed for cruising purposes, mentioned above. Mr. Sneed has a very ingenious provi-

sion for this, with optional controls to suit almost anyone.

"We feel that for the average driver the overdrive should be automatic and speed-controlled. Theoretically, the manual overdrive is correct and most suitable for the expert driver, who knows what it is for and how to use it. But it has been well demonstrated in the past that the average driver either will not or cannot use a manually-operated fourth speed to advantage."

New M. G. Racing Car Has Tuning Fork Frame



A NEW small racing car has just been completed by the British M. G. firm for competition in this year's races. It has a four-cylinder engine with only 750 c.c. (45.75 cu. in.) displacement. The chief novelty resides in the frame which is a single member of tuning-fork form, composed of thin steel plates that are welded together. All sections are of box form. It is stated that the weight of the entire frame is no greater than that of the fuel tank. Independent suspension of the torsion-bar type is used all around. Wheels are mounted at the ends of wishbone-shaped links. Torsion bars for the front suspension are fixed at one end to the lower of the two wishbone brackets, and the wishbone brackets are bolted to an ordinary steering head. Movement of the wheels in both directions is limited by stops,

and the spring action is further controlled by hydraulic shock absorbers made of very light material. No tie rod is used, each front wheel being steered through a separate connection from the steering gear.

At the rear, the lower of the two wishbones is fastened to the torsion bar, the forward end of the bar being held from rotation by means of a lever whose outer end can be adjusted to vary the frame height under static load. The engine has an overhead camshaft which is driven through a vertical shaft at the forward end in which is incorporated a generator. The latter, however, does not act as a charging generator but merely as an electromagnetic damper for the drive.

The drive is through a multiple-disk, fabric-faced clutch which serves mere-

ly as a safety device, limiting the torque which can be set up in the line, and is not under the control of the driver; and through a planetary gear which has smaller steps between ratios than have been possible with this particular make in the past. From the transmission the power is carried through an open propeller shaft with two needle-bearing universal joints in it. The final-drive housing is supported on top of an enlargement of the backbone-type frame. A supercharger of the single rotor type is used and is driven from the forward end of the crankshaft at 60 per cent crankshaft speed, through a metal-type universal joint. The drawing of the chassis reproduced herewith is from *The Autocar*.

Development of Diesels

THE February issue of *Mitteilungen aus den Forschungsanstalten*, published by the Konzernstelle der Gutehoffnungshütte, Oberhausen (Rhld.), Germany, contains two articles of automotive interest, viz., "The Transformation of Design Principles of High-Speed Internal Combustion Engines through the Development of Automotive Diesel Engines," by Dr.-Ing. K. Schlaefke, of the Nuremberg Works of M.A.N., and "Considerations Regarding Cylinder Irons for Air-Cooled Engines, with Special Reference to a Copper Addition," by Hermann Kopp of the Esslingen Machine Works. Both articles are printed in German.

June Ends in Sales Spurt

(Continued from page 1)

Middle Western States, predominantly agricultural areas.

The better outlook for sales has caused several companies to make additional material commitments and to step up their summer schedules. A few weeks ago it looked like July would be a lean month, but bolstered by the heavy Chevrolet schedule calling for at least 115,000 units and with a relatively small decline in the operating rates of other leading producers it now appears that July will show a much more moderate drop in output, which should be well over 300,000 units. The vacation and inventory season has begun at some plants. Cadillac will be closed the first half of July, and Buick is staggering its closing by departments this month. Most plants and some of the offices of motor companies closed for the balance of the week following the July Fourth holiday.

Dodge

Total retail deliveries for week ended June 29 were 9639 comparing with 8347 in previous week. Last week's total included 5141 Dodge passenger cars, 3112 Plymouths, 1386 Dodge trucks. 9026 used vehicles were delivered. First six months' sales stand at 164,171 Dodge and Plymouth passenger cars, 27,474 trucks. Total of 191,598 deliveries against 122,620 for same 1934 period.

Hudson-Terraplane

Last week's deliveries 2402, against 1815 for previous week, increase of 32.3 per cent and gain of 45 per cent over same week year ago.

Pontiac

June production 17,607 units, compared with 6182 in same 1934 month. First six months' output is 107,338, compared with 62,054 for similar period of 1934. Total for all 1934 was 76,533.

Packard

June factory shipments totaled 6513 compared with 390 same month of 1934. Previous best month Oct., 1928, total 5805. Shipped 1862 last week of June. Six months shipment of all Packards, including the 120, were eight times that of year ago, totalling 20,879 against 2565. Big car shipments up 25 per cent during first half of year. Company behind approximately 3000 in orders. July schedule calls for 6400 cars. Dealers increased from 514 to 1104 since Jan. 1.

Chevrolet

June output exceeded 115,000 units. July schedule as high and may surpass June, according to M.E. Coyle, president.

Graham-Paige

June shipments totaled 1750 cars. Highest for any June since 1930. Compares with 1738 in May and 1183 June, 1934. First half shipments were 14,124 cars against 11,489 in corresponding period of 1934.

Chrysler Corp.

Combined retail deliveries of all divisions week ended June 29 totaled 18,656, a new record, compares with 16,859 in preceding week and 13,792 same week year ago. Previous high mark 18,265 week ended April 27.

Plymouth

Deliveries week ended June 29 were 19,244, compares with 9520 for preceding week and previous high of 10,055 in week of April 27. Fourth week this year deliveries passed 10,000 mark. First six months deliveries 214,887, compares with 159,000 same 1934 period.

DeSoto

Deliveries week ended June 29 totaled 712 against 615 in previous week. Second best week for DeSoto. Plymouth deliveries by DeSoto dealers for week ended June 29 were 3318. Making total for week of 4040, a new high.

Chrysler

Deliveries for week ended June 29 were 1173 Chryslers, 3814 Plymouths. Total of 4987 units comparing with 1121 Chryslers, 3782 Plymouths in previous week. First six months deliveries were 23,510 Chryslers, 82,750 Plymouths. Total of 106,260 units. Respective gains of 91.2 per cent, 36.4 per cent, 45.8 per cent for corresponding period of 1934. Used car deliveries were 7417 units. Dealer stocks on June 29 were 33,135 units, 4.6 weeks' supply.

Reo

May registrations were 616 Reo Speed-wagons in U. S. Practically double every previous month of year and every May since 1930. Figures do not include Reos delivered to U. S. government during month.

André Citroën Dead

(Continued from page 1)

borrowed American advertising methods and quickly launched in Europe a bold advertising campaign soon after he began mass production of his cars. He was said to be the first man to have his name written in the sky by an airplane. Since 1925 M. Citroën has been using the famous Eiffel Tower for his artistic night advertising.

PARIS, June 24 (by mail)—The terms of liquidation proposed by the Seine Court to Citroën creditors, to whom more than \$59,000,000 are owing, provided for the issuing of a nominal 100

franc bond and a founder share for each 2000 francs of credit. The bonds will carry interest at the rate of 3¼ per cent for the first four years and 3½ per cent from the fifth year. They will be redeemable in 30 years, starting from the twenty-first year. The founder shares will be entitled to 30 per cent of the profits of the company.

The capital, which at present stands at 400,000,000 francs, will be reduced to 75,000,000 francs and then increased to 210,000,000 francs.

Michelin & Co., the biggest single creditor, Lazare Freres & Co., and the Bank of Paris & Pays Bas, state that they have made arrangements with the André Citroën Company to guarantee the new capital if the present agreement is sanctioned before the end of July. The general meeting will be held on that date, and until then it will be impossible to state which financial group really has control of the company.

Experimental work is being carried out with small Diesels, intended first for taxicabs and express delivery vehicles. Half a dozen cars fitted with a four-cylinder engine of only 109 cubic inches are on the road and have each covered 30,000 miles without trouble.

Subcommittee to Report Eastman Measure July 9

The subcommittee of the House Committee on Interstate Commerce has postponed until Tuesday of next week reporting on the Eastman truck-bus regulation bill. The bill, recently approved by the subcommittee, was to have been reported to the full committee on Tuesday of the present week but action was delayed by the vote in the house on the "death sentence" in the public utilities bill.

Hopkins Going Overseas

Ben F. Hopkins, president of Cleveland Graphite Bronze Co., sails next week for England to visit his company's plant there. While overseas Mr. Hopkins will visit France and Germany to arrange for the manufacture of the company's products in those countries.

Nine Dodge salesmen-fathers exhibit their nine sons born in less than a year. The fathers are members of the S. L. Savidge, Inc., sales force, Dodge dealer in Seattle



Super-Highways By-Passing C

A NEW system of super-highways for long-distance travel was proposed last week in a contribution to a symposium on "The Place of Materials in Automobile Roads and Rides" before the American Society for Testing Materials at its Detroit meeting by John S. Worley, Professor of Transportation Engineering at the University of Michigan. Professor Worley pointed out that today about 70 per cent of the total passenger travel in the United States is over the highways, while intercity transportation of freight for hire on the highways amounts as yet to less than 3 per cent of the total (2.36 per cent in 1932). During the earlier part of the motor era great pressure was brought to bear to get highways located along the main streets of cities; as a result of this policy most of our roads today are nothing more than neighborhood roads and do not permit of the best use of modern cars in long-distance travel. After briefly reviewing the development in road-building methods during the first two decades of the present century, Professor Worley continued:

"In every State there is a crying demand and need for the construction of highways which will permit safe and rapid movement of motor vehicles over long distances. The mileage of these roads needed is not great, in that a few well-located highways would provide all the means for the major part of the distance traveled, leaving a

small percentage of the trip at the terminals to be made over one of the existing neighborhood roads. The joining up of these few high-grade roads would provide a high-class road for travel between distant points in two or more states. . . .

"The characteristics of the location and design of this type of road would require a right of way of a probable width of 200 ft. The initial construction would probably require two separate 20-ft. strips of concrete or some similar economical and efficient paving surface, with grade separations at all the railroads and the principal highways. The right of way should be fenced its entire length with only authorized entrances and exits, and with no structures or businesses accessible to the right of way excepting those needed to service the vehicles and passengers passing thereover. The alignment should be such that the curves would have a factor of safety approximating that of the tangents. The inclination of grades should be such that the slowest moving vehicle would always be able to travel at speeds in excess of 20 m.p.h. The surface of the pavement should be as perfect a plane as possible, having no inequalities which would become hazards to cars traveling at high speeds. The surfaces should also be of a quality to provide the maximum friction, to prevent slipping or skidding in any manner. The visibility along the road, both with reference to grades and curvature, should be such that a motor car at a distance of 1500 ft. would always be readily seen. Branch roads would connect all the adjacent centers of population.

"As has been stated, the initial road should be provided with two separate 20-ft. strips of pavement in order to separate the traffic, thus eliminating all the hazard of two-way traffic on the same pavement. A 200-ft. right of way would provide ample space for widen-

ing the initial pavements as the traffic load demanded, or for additional strips of pavement whereby the traffic could be segregated according to its class, making possible the complete separation by motor buses and motor trucks from private passenger cars."

Commenting on Professor Worley's statement that road surfaces should approach a perfect plane, Maurice Olley, special problems engineer of General Motors Corporation, said the flatness that roads should have needed a definition. What was of vital importance in this connection was the wave length. Mr. Olley explained this point as follows:

The frequencies of a motorcar are two:

- (1) Frequency of unsprung masses, of the order of 540 a minute or 9 per second.
 - (2) Frequency of sprung masses, covering a range from 1 to 2 cycles per second.
- If one now accepts two typical speeds, 45 ft. per sec. for cities and 90 ft. per sec. for the open roads—
- (1) Resonance of the unsprung masses will occur in cities at a wave length of 5 ft. and on the open road at a wave length of 10 ft.
 - (2) Resonance of the sprung masses will occur in cities at wave lengths between $22\frac{1}{2}$ and 45 ft. and on the open road at wave lengths between 45 and 90 ft.

Washboard gravel roads have a wave length of about 3 ft., and it is a common observation that riding of cars on these roads at ordinary "open road" speeds is better than on concrete roads of any but the very best quality.

"One cannot escape the conclusion that the methods adopted for laying out concrete roads are defective, in neglecting this very important question of wave length and in producing inadvertently very slight waves which have an average length somewhere in the range of 50 to 100 ft."

Tire Materials Near Limit

Materials employed in the manufacture of tires were dealt with by K. D. Smith, technical superintendent of the tire division of the B. F. Goodrich Co.

Cities Are Urged

Mr. Smith said American cotton is used almost exclusively in tire manufacture, partly because of an excessive tax on Egyptian cotton and partly because the American cotton has been improved where it is as good as and even better than the Egyptian product.

The longer staple cottons are cabled in a manner to give the best compromise between strength and elongation. The average size of cord used in tires today has a gage of about 0.036 in. and this has a strength varying from 14 to 22 lb. and elongation varying from 12 to 22 per cent at 10 lb. These cords are sometimes woven into a fabric with fine threads as a weft, merely to hold the cords until they can be coated on the calender. Sometimes the cords are run directly from spools through the calender and this, of course, is the most desirable process, because it avoids crimping the cord.

This cord is placed in a tire after being cut on a bias, usually with an even number of plies and with each ply alternating in angle. Considerable work remains to be done by physicists and engineers on the proper angles to be used, because the angle affects such important items as wear of the tread, stability of the tire and development of heat within the tire.

Previous to 1906, when George Oenlager discovered organic accelerators, the curing of rubber articles was a long-drawn-out process. Thirty years ago it required from 60 to 90 min. to cure an average sized inner tube. At the present time only 5 to 8 min. is required. The cure of tires was 3 or 4 hr., whereas now less than 1 hr. is required for the smaller passenger sizes. Lower curing temperatures were also made possible with these accelerators in conjunction with the shorter time for cure, which results not only in better characteristics for the rubber compounds but also better condition of the cotton cords.

Prior to 1912, treads were pigmented with zinc oxide to give wearing quality. In 1912 Mr. Tew, now president of Goodrich, with the aid of Mr. Oenlager, introduced the use of relatively large amounts of carbon black in treads, with a very great improvement in resistance to wear.

The discovery of non-accelerating age resistors was the third major im-

ASTM papers discuss riding qualities, tire materials, oil consumption, fatigue stresses, hardness of light metals and axle gear life

provement in tire compounding. The first American patent for such a material was taken out by Winkelmann and Gray in 1924. As a result of this discovery general tire life was improved in many ways, such as resistance to tread wear, tread cracking, sidewall flex-cracking, carcass flex-breaking, as well as resistance to the deteriorating effect of heat.

The testing of tires is probably more complicated than the testing of any other product and therefore offers one of the greatest problems from the standpoint of specifications. The National Bureau of Standards has struggled for years to write a satisfactory tire specification, but as yet none has been devised which answers all problems. The great difficulty is that laboratory and indoor tests do not reflect the actual results on the road.

In concluding his paper, Mr. Smith said we have not yet reached our limit of automobile speed, which increases the danger from blow-out and skidding; we have not yet reached our limit for the possibility of using lower pressures to improve riding qualities. We have almost reached the limit of counteracting these forces with present materials. Therefore, we must look to new materials or new combinations of present materials to meet the coming demands.

A third paper of the Symposium was by O. T. Kreusser, director of the Museum of Science and Industry in Chicago and formerly director of General Motors Proving Grounds. Mr. Kreusser outlined some of the problems which designing engineers will have to tackle in the near future. He said the need for different cooling fluids in summer and winter respectively should be eliminated, as should the need for oil

changes and spark-plug replacements. Other inconveniences which owners should not have to put up with in future are leaky mufflers and gaskets, frequent need for chassis greasing and for the addition of water to the battery. Mr. Kreusser considers that metal tops add to the appearance of cars, and, of course, they will eliminate trouble from failure of top material.

Much remains still to be done to enhance the comfort of cars in summer as well as in winter, and while the advent of the automatic choke and higher cranking speeds have facilitated starting, it still happens that owners cannot get their cars started even in temperatures well above the zero mark.

Other desirable features in motorcars include sheet metals and plated parts that do not corrode readily, upholstery better adapted to cleaning, and floor coverings that do not warp, shrink or wrinkle.

Success with streamlined cars has shown that changes in appearance need not meet undue sales resistance. Its further development should lead to utilization of useless space in the body and under the fenders for luggage, spare tires, battery, tools, and perhaps a radio set, in such a manner as to make them more accessible and keep them out of sight.

The introduction of improved cutting materials, such as the new boron carbide, permits of the use of harder and tougher materials of construction without adding to production costs. Independent springing, aside from its effect on riding comfort, has added to the safety of cars at high speeds in that it minimizes the effect of a tire blow-out.

Oil Volatility vs. Mileage

When oils of the same series are compared, the oil consumption of an automobile engine is rather closely correlated to the initial boiling point of the oil, but with oils not of the same homologous series there is an absolute lack of correlation between consumption and initial boiling point, according to L. L. Davis and R. D. Best of the Continental Oil Co., Ponca City. These investigators also found that there is less correlation between consumption and the 2.5-, 5- and 10-per cent distillation points of oils of the same series. The effect of volatility on consumption is of minor importance when the consumption is very high as a result of engine design or high engine speed.

The authors pointed out in their paper that although there has been much work on oil consumption and the factors affecting it, the net conclusions which can be drawn from the published literature are far from satisfactory. The general conclusion has been that viscosity is the major factor controlling consumption and that volatility has little or no significance. The majority of the published work has been based on the examination of a limited group of oils, usually varying over a wide range of viscosity. The resultant consumption data when plotted against viscosity show a fairly

good relationship. It seems to have been overlooked, however, that in such a series of oils there is also a fair correlation between viscosity and volatility, and, therefore, if the consumption data are plotted against volatility an equally good relationship might result.

They conceived the idea of the possibility of isolating the effect of volatility by preparing a series of oils in which that was the only variable. This they did by blending several neutral oils of varying volatility with bright stock from the same crude oil, which resulted in finished lubricants all of which had practically the same viscosity index and were very similar with respect to other physical properties. Consumption tests with these oils led to the conclusions stated above.

Hot Spots in Cylinder Walls

Hot spots in cylinder barrels are doubly objectionable, according to M. O. Teetor, in charge of research engineering for the Perfect Circle Co., in that they not only cause the cylinders to warp out of shape, but also make it impossible for the piston rings to control the thickness of the oil film. Some of these spots get so hot that they cannot be lubricated. A part of the cylinder wall particularly liable to such hot spots is at the upper end of the bore adjacent to the valve passage in L-head engines. This particular area is subjected to a blow-torch action of the flame as it passes over the top of the cylinder to the exhaust valve. Insufficient water space between the barrel and the valve pocket, or an inadequate flow of water through this space, is responsible for the high temperatures reached by this section—up to 650 deg. F.

The oil on the surface of a hot spot in the cylinder decreases in viscosity, to the point where the strength of the oil film is not sufficient to withstand the pressure of the piston rings. The hot blow-by gas in the combustion chamber passes between the ring and the cylinder wall, generating more heat, because the oil seal has been broken. Therefore, starting with the breaking down of the lubricant, the temperature of the hot spot increases rapidly and scuffs both the high-temperature area in the cylinder barrel and the surfaces of the piston rings.

The author of this paper ("The In-

fluence of Engine Design on Oil Consumption") described some tests with thermocouples to determine cylinder-wall temperatures of an engine that gave trouble from scuffing of piston rings. After the temperatures had been taken the cylinder was examined for obstructions in the water jacket, and a small quantity of core sand and lime was removed from the space between the cylinder wall and valve ports. This so reduced the heating that there was practically no more scuffing, and the temperatures measured before and after the change indicated that cylinder-wall lubricant starts to break down at around 400 deg. F.

Larger water passages and improved circulating systems have practically eliminated hot spots from cylinder blocks of recent design, in which jets of cold water are directed against the hot areas. In one of these new engines the temperature of the hottest spot varies only 20 deg. F. between 2600 and 4200 r.p.m. under full load. This increases the possibility of effective high speed lubrication.

Cylinder finish is directly related to oil consumption, because if the cylinders are rough originally and the run-in conditions are such that the rings start scuffing, engine life is impaired and oil consumption cannot be controlled.

Piston rings must have the proper shape and pressure characteristics to follow the cylinder wall and oppose as many as possible of the influences tending to make them leave the wall. Of course, it is reasonable to assume that enough pressure could be applied to force them to stay on the wall, but oil films still have their strength limitations, and increasing the wall pressure to such a figure would mean an increase in friction. The reasonable solution seems to lie in improvements in engine design that will eliminate the unfavorable factors affecting the performance of the rings.

How Cold Affects Fatigue

W. D. Boone and H. B. Wishart of the Materials Testing Laboratory, University of Illinois, reported on low-temperature high-speed fatigue tests of several ferrous and non-ferrous metals.

All of the metals tested showed an increase in endurance limit as the temperature was decreased from +80 F. to -50 F. The cold-drawn steel, however, after reaching -20 F. showed no further increase in endurance limit.

The stress-concentration factor as determined by the ratio of endurance limits of the unnotched to the notched specimens showed no consistent change with decreasing temperatures. There was enough variation in the stress-concentration factor to indicate that

further investigation would be of interest.

The high-speed fatigue machines used in these tests operated satisfactorily at low temperatures. These machines proved to be particularly valuable in shortening the time of the tests, since time was an important factor in the operation of the cold room.

Hardness of Light Alloys

R. L. Templin, chief engineer of the Aluminum Company of America, read a paper on "The Hardness Testing of Light Metals and Alloys." He said that in the non-ferrous field, because of the greater softness of the metals, it is generally necessary to make certain modifications in hardness-testing methods in order to get satisfactory results. These changes in test procedure usually involve lower loads on the penetrators, or larger penetrators, or both, in the case of the Rockwell and Brinell tests; and a larger radius of the striking face of the hammer (lower contact pressure) in the case of the scleroscope test. These differences in conditions make it quite difficult to compare hardness values of ferrous and non-ferrous metals when using the prevailing standard methods.

The modifications made in the various instruments and procedures for hardness testing to adapt them for use on light metals and alloys were discussed in the paper. The Brinell test, especially the 1000-kg. load, $\frac{1}{16}$ -in. ball combination, is quite extensively used as a 100 per cent final inspection test on aluminum pistons, made as forgings, sand castings, or permanent-mold castings. This test is also used as a check on the heat treatment of many other light-alloy products in both the wrought and cast condition. The Vickers test so far has been used little in the light-metal field in this country. While both the Rockwell and scleroscope tests have been used to a considerable extent in testing light-metal products, Mr. Templin considers their use in product specifications unsatisfactory. In general, experience has shown the tension test to be preferable to any of the hardness tests, when the form and size of product permit of its use. From tension test values of light metals in the wrought condition, the various hardness values can be computed with satisfactory results.

The tensile strength-Brinell relationship for wrought aluminum alloys may be expressed by the following simple equation:

$$B.H.N. = \frac{T}{575}$$

where B.H.N. is the Brinell hardness number and T the tensile strength in

lb. per sq. in. In giving this equation Mr. Templin said he appreciated that there was a definite minimum to the Brinell hardness numbers possible, corresponding to that obtained with an impression equal to the diameter of the ball used. This minimum value is not zero, as indicated by the equation just given, but the errors resulting are negligible in most instances, and in the interest of simplification have been ignored.

Unfortunately the procedure too often followed is to try to determine the tensile strength of a product from a Brinell test and the relationship just indicated. In doing so the errors involved in the Brinell determinations are multiplied 575 times, with the result that the value for tensile strength obtained by this procedure may be very much in error. On the other hand, if we know the tensile strength of the material, the Brinell hardness can be calculated from the equation given with a very satisfactory degree of accuracy. A similar relationship for Vickers hardness and tensile strength can be worked out with the same pertinent limitations.

H. E. Searle and F. L. LaQue of the International Nickel Co. discussed corrosion-testing methods. Very extensive work had been done on the subject by four committees of the A.S.T.M., they said, but this work had not yielded a simple corrosion-testing method that could be adopted as a standard by metal producers and consumers.

The authors had done considerable corrosion testing themselves, and in the course of this work had developed a new spool-type specimen holder for outdoor corrosion-resistance testing which they described in the paper.

Rear Axle Gear Life

A paper on "Rear-Axle Gears: Factors Which Influence Their Life," was contributed to the meeting by J. O. Almen and A. L. Boegehold of the General Motors Research Division. During the last seven or eight years the Research Division ran breakdown tests on some 400 rear-axle assemblies, and from the results of these tests the following conclusions were drawn:

"For better utilization of material in machine elements the engineer

should first look for possible improvements in design and shop practice before resorting to metallurgical change. The engineer prepares his designs without giving sufficient thought to the stress concentration factors noted herein. His designs often appear to assume that the materials are rigid. Axle bearings are usually selected for their load-carrying capacity rather than for their rigidity, with the result that the gears are heavier than necessary.

"The production man is usually willing to cooperate with the engineer when he is appraised of the detrimental effects of certain shop practices.

"Laboratory tests of standard test specimens are often interpreted as being directly applicable to machine elements without regard to the wide differences in form, finish and type of loading. In the process of manufacture, the machine element may be so altered by surface decarburization, for example, that it does not represent the material of the test specimen.

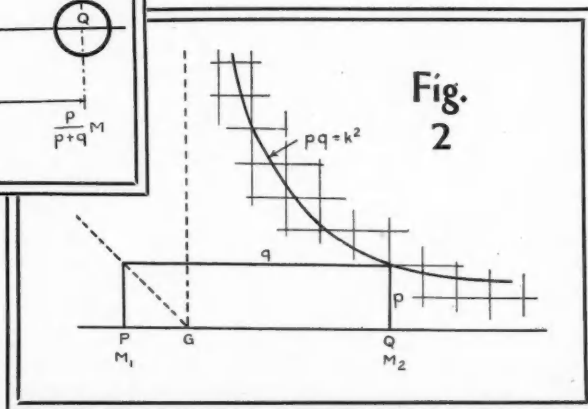
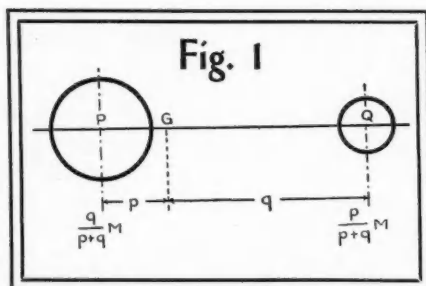
"When laboratory tests are made on actual machine elements, sufficient care is not always taken to assure that they agree with the results obtained in service. Such tests are often more misleading than specimen tests, since the results are more readily accepted at their face value. Reliable testing technique can only be developed by reproducing in the laboratory the type of failure and order of merit encountered in the field.

"Automobile engineers and metallurgists have access to service data. These records, intelligently used, provide means whereby laboratory tests on machine elements may be related to service as in the present study of axle gears."

Studebaker Engineers Describe Experimental

CARS which have low frequencies of oscillation about the transverse conjugate axes around which oscillation takes place when impacts are dealt the sprung mass through the front and rear springs respectively, provide a good ride, and it is particularly important that the frequency be low around the transverse axis near the front axle, around which oscillation takes place when the rear wheels are struck a blow. This was one of the principal points made in a paper dealing with car suspensions, presented at the S.A.E. Summer Meeting by W. S. James, H. E. Churchill and F. E. Ullery of the Studebaker Corporation. The authors presented results obtained in experiments based upon an analysis outlined by Prof. James J. Guest before the Institution of Automobile Engineers in 1926, and to make the experimental work more understandable, they gave a resumé of essential parts of Professor Guest's analysis. The paper is here reproduced in somewhat abbreviated form.

The rotational motion of the sprung mass of the car about its center of gravity G is the same as the rotation (around its axis) of a long thin-walled cylinder equal in weight to the sprung mass whose radius k is equal to the radius of gyration of the sprung mass. The thin cylinder can be replaced by two weights, each one-half the sprung weight, whose centers of gravity are a distance $2k$ apart. This weight system can be replaced by an infinite number of systems whose respective masses and distances from the center of gravity are as shown in Fig. 1. The graphi-



cal method used by Professor Guest to show all possible combinations of p and q is given in Fig. 2. A hyperbola $p q = k^2$ is constructed, using ordinates through the center of gravity and the value of k as the radius of gyration, and a 45-deg. line through the center of gravity then serves to transfer the value of p to the horizontal line. All conjugate points p and q are easily obtained by this method.

Professor Guest then considers the motion of a stiff, weightless bar supported by two springs of stiffness (lb./in.) λ and μ . If such a bar as shown in Fig. 3 is acted on by a vertical force

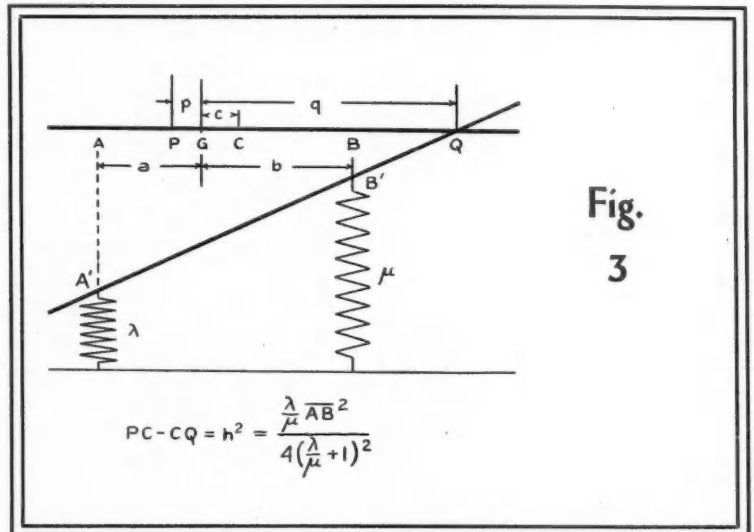


Fig.
3

at point C , it will move down parallel to its original position. This point Professor Guest calls the spring center, and its distances from the points at which the springs act are related to the spring rate by the equation

$$\lambda AC = \mu BC$$

When a force is applied to the weightless bar at some other point such as P , the final position of the bar if extended will intersect the line of the original position at some point Q . If the same force were originally applied at Q , the final position of the bar would be such that its extended line would intersect the original position at the point P . These two points are conjugate, and to the spring rates the relation of their distances from the points of spring support can be expressed as

$$PC \times QC = h^2,$$

where h is a constant and equal to

$$\frac{\sqrt{\frac{\lambda}{\mu}} \cdot AB}{1 + \frac{\lambda}{\mu}}$$

This is a hyperbolic relation.

Having shown that the weight system and spring system can be graphically presented as hyperbolic relations, Professor Guest combines the two as in Fig. 4. In this figure the spring system is represented in accordance with the equations of the preceding para-

Analytical and Riding Quality Studies

Show how to determine constants used in expressions for frequency of oscillation of the sprung mass

graph, and the mass system is superimposed upon it by locating the point representing the center of gravity G on the 45-deg. line through the spring center C . The intersection of the two hyperbolas at point R locates the two conjugate points P and Q . The motion of the sprung mass of a car will be that of independent rotation about these two points P and Q as centers, the weight of the car being considered as divided into two parts, related as shown in Fig. 1. Following the nomenclature of Fig. 3, the period of vibration of point P rotating about Q is

$$T_1 = \frac{2\pi}{a+b} \times$$

$$\sqrt{\frac{M}{g} \frac{q}{p} \left[\frac{(p+b)^2}{\lambda} + \frac{(a-p)^2}{\mu} \right]}$$

and that of point Q about P ,

$$T_2 = \frac{2\pi}{a+b} \times$$

$$\sqrt{\frac{M}{g} \frac{p}{q} \left[\frac{(q-b)^2}{\lambda} + \frac{(a+q)^2}{\mu} \right]}$$

In discussing the motion of the body about points P and Q , Professor Guest says: "These simple harmonic vibrations are completely independent of one another. If the car has one of these vibrations only, it may be considered to rock on a fixed axis at P (or Q), and its vibration calculated as if the axis were actually fixed. If the two modes of vibration exist simultaneously, each vibration will pursue its course uninfluenced by the other, and the movement of any point of the car can be found by the combination of the movements. Thus, with definite conditions as to the start of the motion, the position, velocity, and acceleration of any point of the car at any time can be found. The vibrations of the car body are usually generated by forces transmitted through the springs at A and B , and accordingly both modes of oscillation are usually impressed simultaneously

upon the car. The motion of any point U will thus, in general, consist of the sum of two simple harmonic motions, and its motion will be by no means simple, particularly as the periods T_1 and T_2 will usually have no simple fractional relationship, such as would cause the motion to repeat after a short number of simple periods. The points P and Q themselves will, however, only receive vertical motion each from the angular oscillation about the other."

This rather simple analysis of the motions of the car body assumes that the center of gravity G is in the same horizontal plane as the axles. This, however, is never the case. Professor

Guest then shows that there is some point in the vertical line through the center of gravity which has vertical motion only. This point lies above the plane of the wheel centers and below the center of gravity. The vertical location of this point is dependent upon the ratio of the sprung mass to the effective unsprung mass, considering these two masses as balancing each other when rotated about a horizontal axis through these points. See Fig. 5. The conjugate centers of oscillation will, therefore, lie in a horizontal line through this point, designated by Professor Guest as at a distance l below the height of the center of gravity.

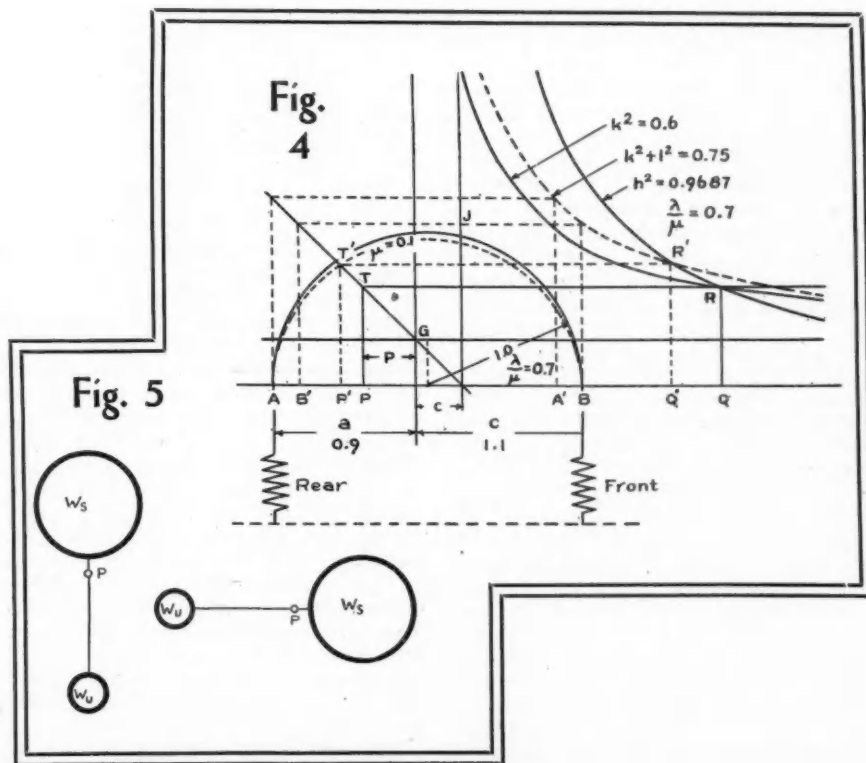
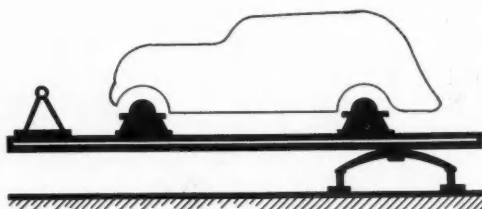


Fig.
6

Professor Guest then analyzes the angular movements of the car with the center of gravity above the line through the conjugate centers P and Q , showing that the original relations still hold if k^2 is replaced by $(k^2 + l^2)$ and that the spring constant h^2 is replaced by $h^2 - lu$, where μ is the distance the center of gravity of the sprung mass must be raised to completely unload the springs.

This modification of the simpler relation changes the graphical solutions as indicated in Fig. 4. The semi-circle of radius $(a + b)/2$ being replaced by one of slightly smaller radius

$$\sqrt{\frac{(a + b)^2}{4 - lu}}$$

The next major factor which Professor Guest introduces is the effect of the spring action of the tires on the mass between the tires and the main car springs. He shows that these factors can be allowed for by considering the stiffnesses of the car springs λ and μ to be compounded with springs of stiffness $(\lambda_2 - m_1\omega_1^2)$ and $(\mu_2 - m_2\omega_1^2)$ giving in place of λ the expression

$$\frac{\lambda(\lambda_2 - m_1\omega_1^2)}{\lambda + (\lambda_2 - m_1\omega_1^2)}$$

and for μ the expression

$$\frac{\mu(\mu_2 - m_2\omega_1^2)}{\mu + (\mu_2 - m_2\omega_1^2)}$$

where λ_2 and μ_2 are the respective tire spring rates, m_1 and m_2 the unsprung masses between the tire and the sprung mass and ω the time (t) per cycle of

oscillation divided by 2π or $\omega = \frac{t}{2\pi}$.

To sum up in Professor Guest's words, he has stated the particular aspect from which the mass system is regarded and developed a theorem concerning the elastic system to enable a clear idea to be obtained of the nature—rocking oscillations about a pair of axes—of the simple primary motions which underlie the main complex vibration, and certain properties and relationships of the system to be established. After considering friction, and rolling unsymmetrical springing, the author has shown that, with certain alterations in the values of a pair of quantities, the conclusions reached apply to a car upon simple springs, and are, thus corrected,

practically adequate. Finally, he has shown that the effect of the axle masses on the primary vibrations can be allowed for in a simple manner, and that in the pair of secondary vibrations which they introduce the car body rocks about a pair of axes, the positions of which are readily found.

It is evident that to check this analysis against actual movements of the car it is necessary to know:

- (1) Radius of gyration of the sprung mass k .
- (2) The front and rear spring rates μ and λ .

Fig. 7



- (3) The vertical and horizontal locations of the center of gravity.
- (4) The spring rate of the tires.
- (5) The unsprung mass.
- (6) The moment of inertia of the wheels and tires.
- (7) The frictional or damping forces acting on the springs and tires.

Most of these factors can be determined by well-known methods. Some, however, are not obtained in regular practice, particularly k , the radius of gyration of the sprung mass.

Our efforts at the experimental determination of the moment of inertia of passenger cars were started in January, 1932, on Sir Charles Denniston Burney's "tear-drop" design with which he visited leading American manufacturers. This car had exceptionally good riding qualities. Sir Burney designed this car so that the square of its radius of gyration was equal to the product of the distances from the front and rear wheel centers to the center of gravity. His theory is that a car built on this principle will have the best riding qualities obtainable as far as can be effected by design.

The first of the series of experiments

were made by jouncing the car alternately about the front and rear axles. The front springs were blocked rigidly and the car jounced on the rear springs to obtain the period of horizontal pendulum thus created. This procedure was reversed for determining the period of the car with the rear springs blocked rigidly.

Calculations for k^2 from the data thus obtained gave us a k^2/ab ratio very much greater than Sir Burney's previously calculated ratio of unity. The errors of this determination were attributed to friction and tire deflection. Friction in the suspension system of the car necessitated the application of considerable force to maintain oscillation. The variation of force applied and of phase of application disturbed the simple harmonic motion necessary to obtain a correct period of oscillation, probably because the disturbing force was not applied at or close enough to the oscillating centers P and Q . Removing the action in the tires by anchoring the axle improved results but little. Swinging the car body as a pendulum called for a rigid point of support, which was not available. A horizontal cradle was constructed of I-beams which was supported at one end by shafting and heavy A frames and at the other by leaf springs as shown diagrammatically in Fig. 6. The tires were removed and the wheels mounted in castings fitting the rims. The springs were then blocked in their normal position and the cradle and car swung by hand as close to its natural frequency as possible. The car was then removed and the cradle supported on tension coil springs and its moment of inertia determined. From these two periods and the previously determined locations of the center of gravity of the car and cradle, the moment of inertia of the car was computed. The results obtained from this horizontal pendulum, employing high-rate leaf springs, gave us a k^2 for Sir Burney's car equal to 38.5 ft.² or a k^2/ab ratio of 0.91, causing us to assume that an error of 10 per cent still existed.

It was found at once that the friction in the leaf springs made it difficult to determine the true period. In addition, we did not believe the results. In order to check the results, several die blocks were obtained, of a total weight about equal to the car, and their moment of inertia determined experimentally and compared with computed values. A battery of coil springs of approximately four times higher rate than the leaf springs was installed and with this combination a still higher error was obtained. However, it was observed that the pendulum would oscillate at its natural frequency (without external force applied) for a much longer period than had previously been observed with the lower-rate leaf springs. This permitted us to obtain a very definite natural frequency of the system, and hence leaf springs were abandoned. Data were then taken on the cradle only, with high and low-rate coil springs. The comparative results showed the experi-

mental determination of the moment of inertia of the cradle with low-rate springs to be only 2.2 per cent smaller than the calculated moment one. It was concluded from these tests that low-rate springs gave the best results because the period of the supporting springs was much lower than the natural frequency of the cradle I-beams.

The large errors in the results obtained with full-scale tests put in question the correctness of the method of using a horizontal pendulum. As a result, a further series of tests were made on a small laboratory set-up. This apparatus consisted of a test stand on which was mounted a frictionless pivot for a horizontal rod. The opposite end of the horizontal rod was supported by a coil spring of very low and practically uniform rate, having its upper end attached to a fixed support. A sliding ball mounted on the horizontal rod provided a method of shifting the mass of the pendulum. Tests were made with the ball in various positions on the rod, and the experimentally determined moments of inertia thus obtained were compared with the calculated values. The results of these experiments which gave a 0.75 per cent average error and a maximum error of 2 per cent are shown in Table I.

Next, there arose the question of effective spring rate and point of action of the springs. This was answered by calibrating a battery of springs in place and mounting them so that they acted through knife edges on the cradle. While these items were being checked with die blocks, it became evident that the effect of the location of the weights on the cradle was important, because of the lack of complete rigidity of the I-beams and the fact that the natural period of the cradle I-beams was apparently too close to the period of the supporting springs. A new set of lower-rate coiled springs was then obtained and the results rechecked. The best results were obtained when the weights were located over the springs and as close to the fixed hinge point as possible.

Fig. 7 shows the arrangement which the authors believe to be the most satisfactory and least expensive. No raised hinge support is required, the car weight being located directly over the points of support, and the moment of inertia of the supporting cradle is a minimum. In measuring *k* for various passenger loadings, it was necessary to remove the seat cushions, to use weights fastened into place, and to remove the gasoline from the tank. The damping action of people sitting on cushions or gasoline swashing about in the "gas" tank caused the period of oscillation to be indefinite.

The detailed procedure in determining the moment of inertia is as follows: Each wheel is clamped into its bracket with a hoop to prevent any change in the position of the car during the test. All chassis springs are blocked in their free-carrying position for the particular loading. The necessary number of coil springs are installed under the cradle

to properly suspend it and shims are placed between the floor and spring bases to bring the cradle horizontal. At the rear end of the cradle a Veeder counter is attached with a short arm, as a help in counting the oscillations. Very little effort is required to oscillate the cradle—care being exercised that its vibration is not forced. Five time readings are taken, each for 100 complete oscillations. These time readings seldom vary more than 0.15 of a second in 80 to 100 seconds for the 100 complete oscillations. The amplitude at the counter is about ½ in.

The coil springs are calibrated for each passenger loading by a load-deflection test. The load is applied at the rear end of the cradle with accurate weights. The arc of deflection is measured with dial extension gages at right angles to a line from the hinge to the gage point. The angular spring rate in lb.-in. per radian is

$$\frac{\text{moment (lb.-in.)}}{\text{arc (radians)}} = \frac{\text{load (lb.)} \times \text{horizontal distance from hinge to load (in.)}}{\text{arc (in.)}}$$

Radial distance from hinge to gage.

This figure for the total car is usually about 12,000,000 lb.-in. per radian.

The period and the spring constant determined, the moment of inertia of the car and cradle about the hinge is given by the formula

$$12 \times 32.16 \times \text{Period (secs.)}^2 \times \frac{\text{angular rate, in lb./radian.}}{4\pi^2}$$

The numerical value varies from about 75,000,000 to 110,000,000 lb.-in.², depending on the car and the loading.

This procedure is followed for each loading; road less gas, road, road plus driver, road plus three passengers, and road plus five passengers. Each "passenger" consists of three standard 50-lb. weights. The location of the passengers, as well as the gas-tank location, is measured with respect to the rear-wheel center line.

Table I

Comparison of Experimental and Calculated Moments of Inertia for Different Locations of Center of Gravity

Ball Location From C. of Oscil.	Oscillations Per Second	Moment of Inertia		Per cent Error
		Exp.	Cal.	
7 in.	1.145	54.5	54.1	+0.1
8 in.	1.037	66.4	66.6	-0.3
9 in.	0.952	78.9	80.6	-0.2
10 in.	0.868	94.8	95.4	-0.7

The sprung mass of the car is removed from the cradle. The unsprung mass consists of wheels, brakes, axles (or one-half of swinging arms), and one front and one rear spring in position. These parts are all clamped in the proper position. The cradle is properly suspended and the period and spring constant are determined as before. This gives the moment of inertia of the unsprung mass less tires, and the cradle parts, about the hinge. This figure is about 39,000,000 lb.-in.² of which about 28,000,000 lb.-in.² is the moment of inertia of the cradle. The moment of inertia of the cradle and unsprung mass subtracted from the moment of inertia of the complete car and cradle gives the moment of inertia of the sprung mass about the hinge, which is of a magnitude of 38,000,000 to 59,000,000 lb.-in.², depending on the loading.

The unsprung parts are removed from the cradle and weighed, and the centers of gravity of the front and rear assemblies are determined. From these data the total unsprung weight and the location of the center of gravity with respect to the wheel centers are calculated. Having the center of gravity and weight of the car complete and that of the unsprung mass, the weight and center of gravity of the sprung mass are readily determined. The horizontal center of gravity of the sprung mass usually shifts forward for light loadings and backward for heavy loadings from that of the complete car. The vertical center of gravity is 2-3 in. above that of the complete car.

The location of the front wheel center from the hinge was measured with the car on the cradle. The front wheel center was about 50 in. from the hinge horizontally and about 6 in. below it vertically. Thus, the distance of the center of gravity of the sprung mass from the hinge is known. From the moment of inertia at the hinge subtract the product of the unsprung mass times the square of its distance from the hinge. This product is a magnitude of from 32,000,000 to 40,000,000. The moment of inertia of the sprung mass at its center of gravity for a moderate-sized car ranges from 6,600,000 to 8,000,000 lb.-in.² from "road less gas" to five-passenger loading.

When the car was on the cradle the locations of the passengers and the gasoline were measured. Thus their effect may be directly computed. These effects subtracted from the experimentally determined moment of inertia gives five figures for "road less gasoline" loading which should be equal. This serves as a partial check.

When the car is still apart, the heavier rotating masses are swung as compound pendulums on a knife edge, and their moment of inertia is determined. Usually one wheel, tire and tube assembly and one front and one rear brake drum are tested in this manner. These parts have a small effect on the height of the horizontal plane of the points of oscillation.

The spring rate determination is

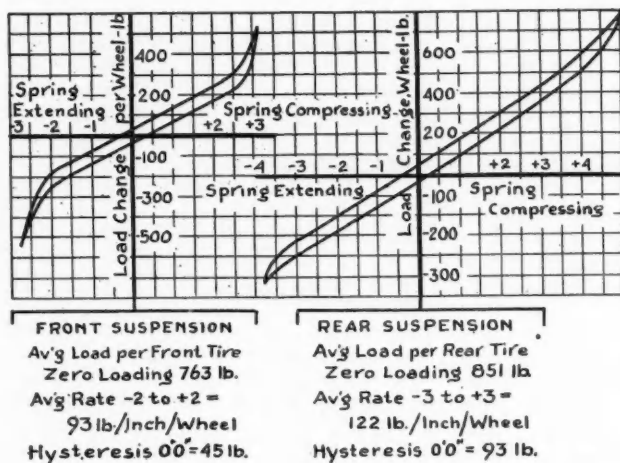


Fig. 8

Load Deflection
 curves spring rates
 at wheels.

merely a deflection-load test. The sprung mass is deflected with respect to the wheel center and the change of tire load is measured. In our work the car is placed on four platform scales, permanently set in the floor, one under each wheel, and the car weighed. Fastened to the floor around the car is a steel structure with adjustable cross members. On these cross members are long power screws with hand wheels. To the end of each frame horn one of these screws is attached through a swivel nut and bracket, on each fender directly over the wheel a reference mark is scribed. The entire sprung mass may be raised or lowered by the screws as desired. Usually only one end of the car is changed. The vertical deflection being small, compared to the length of the car, the angular error is immaterial. Leaving one end of the car at the normal position, the other end is raised until there is only about 150 lb. on each tire. The scale readings and the heights of the fender mark from scale platforms are measured as the sprung mass is lowered by increments of $\frac{1}{2}$ - $\frac{3}{4}$ in., until the spring bumpers are well compressed. The same procedure is followed as the springs are returned to their extended position.

These results include the tire deflections, which are corrected for from the tire load-deflection curves to give the net deflection between the sprung mass and the wheel center. These results are plotted about the normal carrying position as zero. The average slope indicates the spring rate. Usually this is taken over a range from about $1\frac{1}{2}$ in. extension to 2 in. compression for the front suspension, and from about 3 in. extension to 3 in. compression for the rear. The spring rates of independent front suspensions range from about 90 to 150 lb. per inch per wheel. Conventional front suspensions range from 140 to 350 lb. per inch per wheel; rear suspensions, from 120 to 150 lb. per inch per wheel. The hysteresis loop indicates the total static friction in the

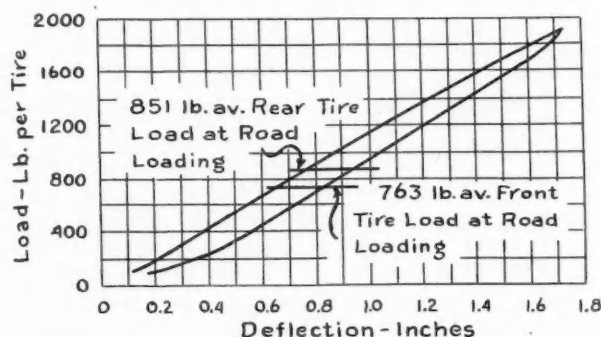


Fig. 9

Load — Deflection
 curves 5.50 x 17 in.
 tires. Air pressure 27
 lb. per sq. in. Tire
 rate at road loading
 = 182 lb. per in. per
 tire. Hysteresis =
 112 lb. per tire.

suspension at the normal loading. For greased leaf springs this friction varies from 70 to 150 lb. per wheel. For independent coil spring suspensions it is from 40 to 60 lb. per wheel. A representative curve of front- and rear-wheel spring rates showing the hysteresis loop is given in Fig. 8.

The tire rate determination is a simple load-deflection test at the recommended air pressure. In our tests, a stiff beam about 20 in. long, with wheel hubs welded to each end, is used, with a wheel and tire assembly bolted to each end. This assembly is mounted on an Olsen test machine. The loads are applied at the center of the beam, the re-

it was possible to compute the location of the conjugate centers of oscillation P and Q and the natural periods about these centers. The results of such computations are given in Table II for six different cars of about the same weight and wheelbase. After these computations were completed the question naturally arose whether the results correctly represented the motion of the car body. In an endeavor to check these computations experimentally, a set-up was made which is shown diagrammatically in Fig. 10. This arrangement consists of two heavy planks, one under the wheels on each side of the car, mounted on knife edges at one end and

Fig. 10

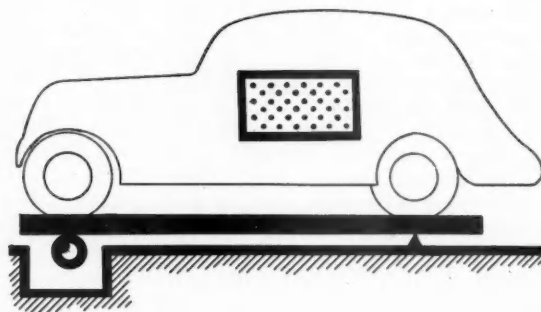
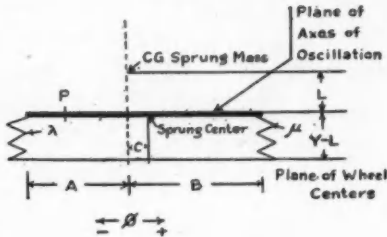


Table II—Computed Locations of the Centers of Oscillation and Frequencies About These Points



Car	Car Loading	Effective Spring Rates		Plane of Axes of Oscillation above Wheel center line Y-L	Mass Constant (In.) ² $K^2 + L^2$	Elastic Constant (In.) ² $H^2 - LU$	Axles of Oscil		Frequ About P	Ncv About Q
		Rear λ	Front μ				P From Rear Wheels	G From Front Wheels		
A	1 Pass.			11.8	2660	3140	-61	-35	80	91
Ride	2 Pass.	274	212	11.8	2520	3140	-101	-49	78	90
Fair	3 Pass.			12.1	2560	3140	42	415	84	75
B	1 Pass.			11.8	2680	3330	-157	-49	80	90
Ride	2 Pass.	277	216	11.7	2540	3330	-245	-54	78	90
Fair	3 Pass.			12.2	2580	3330	38	203	85	74
C	1 Pass.			12.6	2810	3140	-39	-28	69	78
Ride	2 Pass.	221	170	12.1	2670	3140	-63	36	68	77
Good	3 Pass.			12.4	2730	3140	46	1114	70	66
D	1 Pass.			12.2	3430	3050	-8	-4	94	78
Ride	2 Pass.	238	435	12.2	3270	3050	2	9	93	77
Good	3 Pass.			12.0	3170	3050	6	4	93	71
E	1 Pass.			11.6	2890	2940	7	4	116	78
Ride	2 Pass.	250	437	11.1	2730	2940	11	7	115	77
Fair	3 Pass.			10.9	2710	2940	7	4	116	70
F	1 Pass.			11.2	3000	3170	29	65	80	77
Ride	2 Pass.	246	230	11.3	2850	3170	35	111	80	75
Good	3 Pass.			11.7	2840	3170	13	19	80	69

on an adjustable eccentric at the other. The car was rolled up on these planks until either the front or rear wheels were vertically above the center of the shaft carrying the eccentric, and the knife edges were then placed vertically under the rear wheels. The eccentric shaft was rotated at increasing speeds until a speed was found which corresponded with the natural frequency of the car body.

A light, stiff board covered with regularly spaced dots mounted on one side of the car was photographed, using a time exposure, until the apparent center of rotation of the sprung mass was located. The data obtained from these photographs should give the location of point P when the front wheels are oscillated and of point Q when the rear wheels are oscillated. It also should give the vertical height of the plane of the axis of oscillation (*Ht.* of C.G.—*l*) and the natural frequency about points P and Q. Table III gives these data as obtained experimentally on six different cars of approximately the same weight and wheelbase, compared with the calculated values given in Table II. It will be noted that the agreement leaves much to be desired. In general, the greatest differences occur in the distances of point P from the rear wheels and the frequency of oscillation about P. The discrepancies are greatest when the wheels over the stationary knife edge have leaf springs (Cars D, E and F) and when point P is far behind the knife edge. Under these two conditions friction in these springs may very markedly disturb the location of point P, or make it difficult

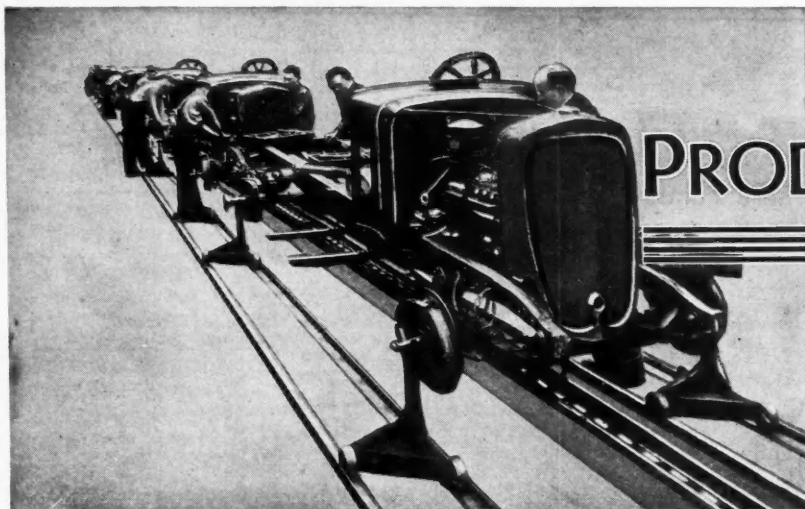
to determine, because rotation about points P and Q may not be independent. It is interesting to note that the vertical location of the line of centers through P and Q is in very good agreement with the calculated value. Further, in the case of cars A, B and C (which had coil front springs) the agreement in frequency about the point Q at the front of the car is very good. These facts point to friction in the springs as the cause for the large discrepancies between the calculated and observed results. It is possible that a greater throw of the eccentric (more than 1 in.) would reduce the effect of friction. As the determination of natural frequency was observed independently of the location of center of rotation, it would be possible to compute one from the other, and in this way ob-

tain an additional check on the effect of friction.

Referring again to Table II, a few interesting relations may be mentioned. The general opinion of quite a few observers rated these cars with respect to riding comfort in the order D-F-C-E-A-B. Cars D, F and C were quite good rides, A and B rather poor. Some of the differences in the cars are in all probability due to differences in shock-absorber control. Cars A, B and C used coil springs on the front and the usual stabilizer bar at the rear. Cars D, E and F used leaf springs all around. It will be noted that the good riding cars had the lower frequencies about P and Q (particularly about Q, i.e., the point of rotation near the front axle produces pitching in the rear seat).

Table III

Comparison of Calculated and Observed Locations of P and Q and the Frequencies about these Points													
Car	A		B		C		D		E		F		
	CAL	OBS	CAL	OBS	CAL	OBS	CAL	OBS	CAL	OBS	CAL	OBS	
X-L	12	12	12	13	12	13	12	12	11	11	11	12	
P from rear wheels.	-62	-11	-157	+44	-39	+41	-9	+14	+8	+17	+29	+26	
Q from front wheels	-36	-45	-50	-50	-36	-29	+2	-4	+7	+5	+76	+66	
Frequency about P ...	80	90	80	89	69	82	95	100	117	121	81	96	
Frequency about Q ...	92	91	91	91	78	78	78	86	79	82	78	92	



PRODUCTION LINES

Leather Seals

A cross-section of typical applications of oil retainers will be found in a brochure just issued by Chicago Rawhide. Specific automotive applications are of course of direct practical value but much may be learned from the way other types of seals have been worked out. Engineers and designers should have a copy—ask us for it.

Labor Relations

Met the president of one of the really big parts companies at the summer meeting. Here's a man who is an idealist when it comes to dealing with his workers. What troubles him is the racketeering element in the labor unions. For example there is the device of getting together a handful of workers to form the nucleus of a union group, then pressing demands so as to force the rest of the men in line. There is no doubt of the need for better relations between workers and management, but it is doubtful whether the cause of the workers is always in good hands.

Gage Changes

There has been a concerted movement afoot to simplify the existing order of gage sizes on wire and flat spring stock. One of the largest organizations has developed a system of specifying small spring stock gages by decimal notation cutting down the number of sizes in use. Comes a large user of flat spring stock with a standardization program that bids fair to eliminate the B.W.G. system which they consider to be wholly inadequate. Here is a

program that should enlist the sympathy of steel users as well as producers. Some confusion is to be expected at first due to the presence of the new and old standards. But eventually much good should result. Your comments would be most helpful.

Strong Alloys

The most complete handbook ever published on the strong alloys of aluminum has just come over our desk. In addition to a comprehensive discussion of the alloys, their application in structures, and methods of fabrication, the handbook features a section devoted to tabular data. The tables in the Appendix cover physical and chemical properties as well as commercial tolerances on shapes, tubes and sheet. Be sure to get your copy of "Alcoa Aluminum and its Alloys."

Cemented Carbides

It's quite likely that one of the big features of the coming Machine Tool Show will be demonstrations of cemented carbide tooling on many of the new machines. Cemented carbides were given life at the last show in 1929. The show of 1935 will demonstrate the phenomenal growth of this tooling development, much of which is intimately related to improvements in machine tools necessary for the most economical utilization of the newer cutting tool materials.

Fluid Tips

The Houghton Line for June and July submits the following eight points which are criteria of the functions of a cutting fluid:

1. Convection of heat during machining.
2. To provide a film of great strength between the tool and the work.
3. To secure penetration and permeation of the cutting fluid.
4. To assure against breaking down of the cutting oil in use.
5. To increase the life of tools.
6. To insure good finish and accurate dimensions.
7. To carry away the chips with minimum "make-up."
8. To reduce power consumption.

Many Gages

More than 14,000 gages and other inspection devices are used in the inspection of work that goes into the making of a Packard One Twenty car, say Packard factory officials. They range in size from two ounces to 18,000 pounds and one is so delicately accurate that it could detect an error of one millionth of an inch.

Plating Aluminum

Understand that one of the big steel producers has adopted a low-cost commercial process of coating steel sheet with aluminum. The first use is far removed from automotive application but there may be places where a coated strip of this character will be found very useful.

Steel Heads

Have been told about a steel cylinder head that incorporates a very interesting feature. The idea is the use of copper inserts at points of great heat concentration.

J. G.



NEW DEVELOPMENTS

Automotive Parts, Accessories and Production Tools

Single Cycle Gear Finishing Machine

Gleason Works, Rochester, N. Y., now offers a new machine and method for finish cutting spiral bevel and hypoid gears. It is known as the No. 11 single cycle gear finishing machine and the method employed is said to be the fastest yet devised.

The gear to be finish-cut is previously rough-cut in the standard Gleason roughers, and then transferred to the new machine for finish cutting. The face-mill finishing cutter used consists of two series of inserted blades. First there is a series of blades of progressively increasing depths which accurately shape and space the tooth by a succession of very light cuts. Then follows a series of finishing blades, each cutting the full depth, which finally size the whole profile of the tooth and produces the desired smooth finish and accuracy of spacing. The cutter and gear remain in normal full-depth operating position during the entire machine cycle and provision is made for indexing by a gap in the cutter which follows after the second series of blades. When this gap comes abreast of the blank, the blank is indexed.

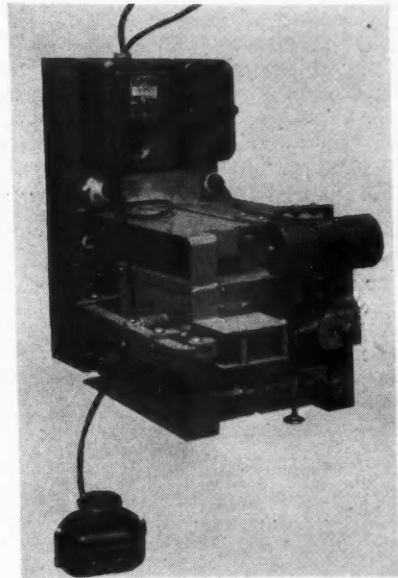
Chuckling and dechucking operations have been facilitated by means of a power chucking and stripping mechanism, built into the work-spindle and controlled by a conveniently located lever. All fatiguing manual operations have been eliminated and the time required to replace a finished gear with a rough-blank has been greatly reduced. The operation of the control lever gives the following results in the order listed:

(a) Gear is clamped to arbor.
(b) Work-head is advanced to cutting position.

(c) Work-head is clamped.
The automatic Stop, which functions to stop the machine when the last tooth is cut eliminates any possibility of re-cutting. The stop resets itself after each gear.

A hydraulic unit carrying 600 pounds per square inch pressure supplies power for the hydraulic functions. It is driven by a separate 2 H.P., 1200 R.P.M. Motor.

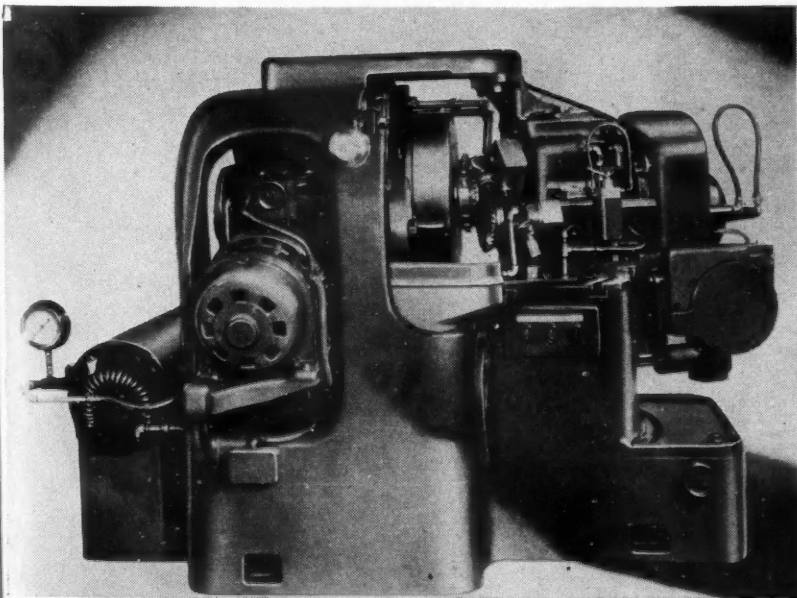
The coolant supply pump is driven by a separate motor of $\frac{3}{4}$ H.P., 1200 R.P.M. capacity. The cutter is driven by a 3 H.P., 1200 R.P.M. motor through a minimum number of gear meshes. It is mounted on a support integral with the cutter spindle housing, which is clamped to the main frame for additional support.



Berwick Electric Valve Stem Heater

The new a.c.f. Berwick Electric Valve Stem Heater for giving an end-heat on practically any diameter rod on which the heat does not have to be more than once or twice the diameter. The illustration shows the heating of the end of a valve stem for hardening purposes. The temperature

is determined by the use of the Electric Eye, which releases the jaws, causing the piece to drop into an oil-bath. This Heater is also built with a delayed action for a soaking period, i. e., when the Electric Eye is set for a given temperature, when this temperature is reached the Electric Eye starts an electric time-clock which holds this temperature for the required time interval before releasing the piece.



Fibro-Forged Screws

Fibro-forged screws are manufactured by a new process by the Holo-Krome Screw Corp., Bristol, Conn. In screws with hollow heads (to take a socket for tightening) it is claimed that the new process of manufacturing results in continuity of fibers throughout the shank and the socket. In the manufacturing process the core fibers remain in place in the shank; they are laterally deflected to form the bottom of the socket, and they are compacted to add to the strength of that portion below the socket and above the shoulder.

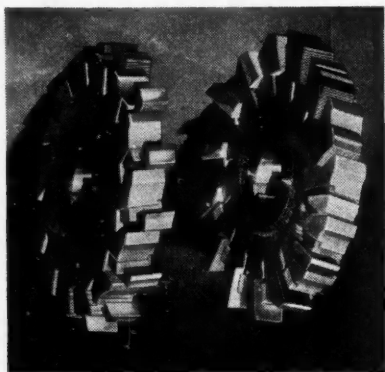
Concentricity of head and shank is said to result naturally from the manufacturing process and assures concentricity of the head in the countersunk hole. The shoulders on these screws are claimed to be perfectly square with the shank and without tool marks or blemishes.

NEW DEVELOPMENTS

Automotive Parts, Accessories and Production Tools

Ingersoll Zee Lock Side Milling Cutters

The Zee Lock cutter blade recently introduced by The Ingersoll Milling Machine Co., Rockford, Ill., has now been applied to inserted blade side milling cutters. Securely retained in the cutter housing by a zee shaped wedge, which hooks the front of the cutter body and the back of the blade, it is impossible for the blade to shift backwards or inwards away from the cut. The back hook of the edge is on a slant so that when the cutter blade is reinserted and moved out a serration it moves forward a slight amount, compensating for the slight amount of wear on the face of the cutter. No additional parts or shim are required for resetting. The blade is adjustable in proper proportional directions of wear. The wedge is the locking member and is not disturbed by the thrust of the



cut as this is absorbed by the serrations. The serrations further increase the area of frictional contact for locking.

Half Side Milling Cutters, made right or left hand as shown, incorporate the Zee Lock Cutter Blade. Staggered tooth or alternate angle cutters, used for slotting or Keyway operations, may be readily resized for width, as the alternate Zee Lock cutter blades move axially when adjusted radially for wear. Plain side and inter locking cutters, with plain wedge locks are also offered. Cutters are made as small as 4 in. diameter by ½ in. wide.

Hand-ee Grinder

Chicago Wheel & Mfg. Co., Chicago, Ill., has placed on the market their Deluxe Hand-ee Grinder for light grinding, drilling, polishing, sawing, and engraving. This tool should be of interest to tool makers, pattern shops, and experimental shops.



The total weight is only 12 oz., length 6 in., diameter 1½ in. Motor is of the universal type for operation on A.C. current from 110-120 volts and D.C., 25 to 60 cycle. Speed is 25,000 r.p.m. Statically and dynamically balanced.

X-Ray Inspection on Production Line

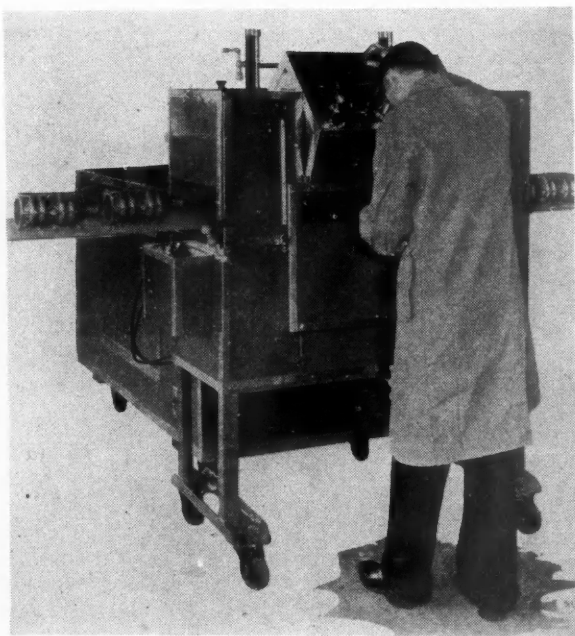
Manufacturers can now "see through" their products on the production line and detect flaws or stray pieces of foreign materials, according to an announcement by the Adrian X-Ray Manufacturing Company, 3535 North Palmer Street, Milwaukee, manufacturers of X-ray machines. As products pass through the machine on

a conveyor belt, the operator looks through an eye piece to get an interior view of each unit. Any unit which does not come up to requirements can be marked for rejection by means of a pointer device.

This is said to be the first time it has been possible to make an X-ray inspection fluoroscopically of goods in motion on the production line. The machine also has a radiograph attachment for making X-ray photographs, in case these are desired of any specific product.

Aluminum castings are examined for flaws in the metal, mica or bakelite is inspected for metal objects which might interfere with its efficiency as insulation, slate for rust spots, asbestos shingles for cracks, porcelain for cracks, and so on. Fluoroscopic work has been done through one-fourth inch of plate steel, and radiographing with one inch of steel.

Although it has a voltage capacity of 150,000 volts, the unit requires only about the same amount of current necessary to operate two ordinary flat irons. Special tubes have been constructed and a cooling arrangement devised which permit continuous operation of the machine during working hours. No technical knowledge is required by the operator, who is in no way exposed to rays of the machine.



SOME NOTES ON BETHLEHEM ALLOY STEELS

II -- Nickel Steels

NICKEL is an alloy which goes into solution in steel (ferrite) and has not only the effect of imparting greater strength but also improves the ductility of any heat-treated part, either by annealing, normalizing or quenching and drawing. Nickel steels have proved their dependability in wide applications over a number of years.

Nickel steels fall in the S. A. E. 2xxx classification. The most widely used nickel steels contain from 3.25 to 3.75 per cent nickel. Other nickel steels, given in the order of their relative popularity, are those containing 5.00 per cent, 1.50 per cent and 0.50 per cent nickel.

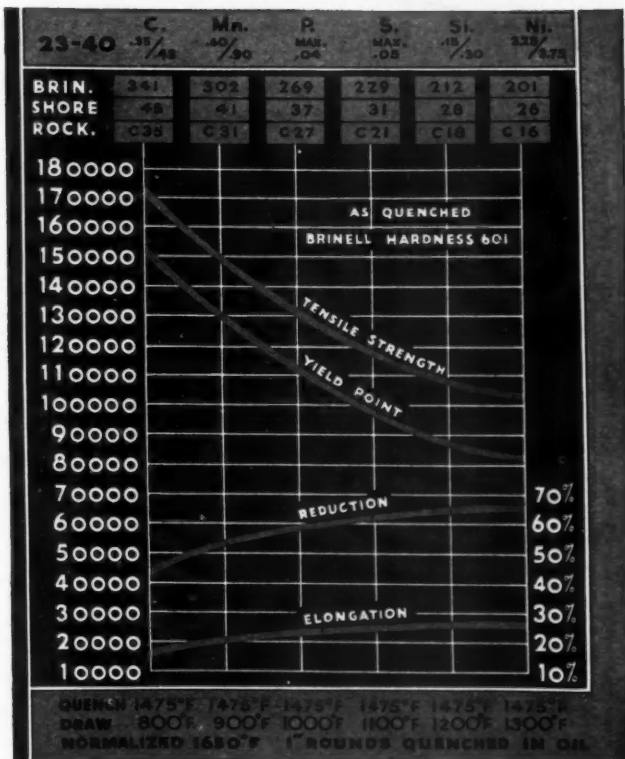
Nickel steels are used in parts where high strength, as measured by yield point, elastic limit, tensile strength and Brinell hardness, must be combined with high ductility and resistance to shock. To realize the maximum combination of properties nickel steels, like all other alloy steels, must be heat-treated.

With a low carbon content (up to 0.25 per cent) the widely used 23xx Series finds application, in the carburized and heat-treated condition, for king pins, rock-drill parts, air-hammer parts, collets, leveler rods, piston pins, universal joints, shackle bolts, spline shafts, rocker arms, gears of all types, countershafts and studs.

As their carbon content increases, the 23xx steels have wide general industrial uses. In the 0.35 to 0.45 carbon range they are used, in both the water- and oil-hardened condition, for heavy-duty shafts, stud shafts, set screws, studs, bolts, steering knuckles, drive shafts, airplane crankshafts, rocker arms, engine bolts and studs, connecting rods.

With higher carbon—0.45 to 0.55 per cent—the 23xx Series becomes oil-hardening, and is used generally for parts requiring exceptional strength, such as heavy-duty gears, pinions, shafts, axles, spindles.

The 25xx steels, containing 5.00 per cent nickel, are carburizing steels. They combine excellent wearing surface with an extremely strong, ductile and shock-resisting core. They are useful for unusually heavy-service parts, such as truck and bus gears, spline shafts, piston pins, countershafts, drive gears, airplane-engine parts. In the heat-treated condition, without carburization, the toughness of these steels lends them to such applications as piston pins for hammers and turbine blading.



★ Physical properties of S. A. E. 23-40, a reliable and popular nickel steel. ★

Nickel steels containing 0.50 and 1.50 per cent nickel (20xx and 21xx) are ordinarily used, in the lower carbon ranges, for carburized parts; they possess greater toughness than carbon steels under parallel conditions, being used extensively for service gears. They are used also, without carburizing, for such parts as engine bolts, stay-bolts and rivets, and for locomotive spring-rigging.

For highly stressed and reciprocating parts of locomotives nickel steel of the following composition is rapidly coming into use: carbon, 0.20 to 0.30 per cent; manganese, 0.75 to 0.95 per cent; silicon, 0.15 to 0.30 per cent; nickel, 2.50 to 3.00 per cent. This steel is usually put in service in the normalized and annealed condition; but in the case of locomotive axles some railroads quench and draw.



BETHLEHEM STEEL COMPANY

GENERAL OFFICES: BETHLEHEM, PA.

PROVED STAMINA

AUTOMOBILE engines frequently go into other types of service where the usage they get is far more severe than in motor cars.

Large numbers of Ford V-8 engines are supplying power for industrial purposes, marine work and in the agricultural field. They are operating air compressors, generators, industrial locomotives, irrigation pumps and feed cutters. In these and many kindred uses they are giving complete satisfaction, supplying economical and dependable power.

Especially in marine work — a real test for an automobile engine — the Ford V-8 has proved its ability to stand up under heavy loads at sustained high speeds. This has won the praise of many marine manufacturers. One states: "We recognize it as the finest in its horsepower range for conversion to marine work, regardless of price. Our judgment is backed by 29 years of experience in designing and building marine engines exclusively."

Ford V-8 engines have what it takes for this class of service — they have stamina.

F O R D M O T O R C O M P A N Y

